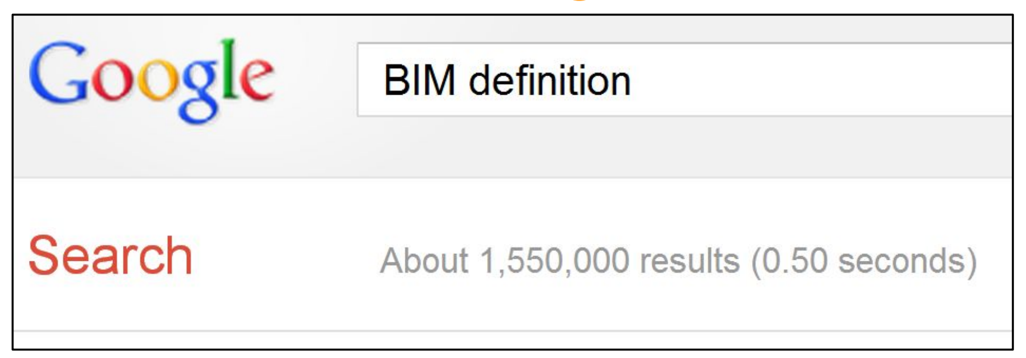
BIM IMPLEMENTATION

Omar Selim



What is BIM?

Building Information Modeling Management



“a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward.”



Why BIM?

- Better, faster, more cost effective built assets
- ...across whole life – Build, Operate & Maintain
- Earlier visual understanding – clients, operators, users
- Early Employer's Information Requirements
- Greater outcome & cost certainty, fewer changes
- Lower risk premium, higher utilisation
- Lower carbon, waste & H&S incidents
- Target 20% CAPEX, 33% WHOLE LIFE savings





Site meetings with BIM



Setting out with BIM



Understanding construction...



Operations & maintenance with BIM





Current Industry Practice

Owner Team

Tools focused on the owner team:
- Capital planning software
- Financial software
- Operations software

Communication between teams:
- Mail
- Shipping services
- Fax
- Email
- File transfer protocol (FTP)
- Internal servers configured for access through a firewall

End Result

- Potential delays
- Unexpected costs
- Non-environmentally friendly (paper & shipping)

Design Team

Tools focused on the design team:
- Project Information Management (PIM) software
- Design software
- Office management software

Construction Team

Tools focused on the construction team:
- Project management software
- Bid management software
- Estimating software



Rest of your project team

Document Control

RFIs & change orders

Field Inspections

Handover

How do I…

- Access models **on my mobile device**?

How do I…

- **Distribute** huge BIM files?
- Reduce cycle times on **clash resolution**?
- **Version control** to avoid errors on out-of-date models?

Design team

Authoring tools

Coordination tools



Driving everyone project-wide to participate in BIM

Rest of your project team

Open BIM, IFC, COBie

Document Control

RFIs & change orders

Bidding & Tenders

Workflows & approvals

Commissioning

Submittals

Packages & Deliverables

Field Inspections

Handover

Open BIM Handover

Design team

Native model data

Coordination tools



Smarter and faster processes and decisions

- Project-wide clash detection / design coordination

Updates model, submits to Aconex

Retrieves models, runs clash detection

Retrieves assigned clashes

Submits clash report, assigns to disciplines

Designer / Engineer

BIM Coordinator



Informed and connected review cycle

- Project-wide access to the model

Finds issue on site, checks BIM model

Raises RFI

Receives RFI, clicks through to BIM model

Reviews linked information for full context

Responds with instruction

Resolves issue on site

Contractor

Designer / Engineer



e BIM project lifecycle

Detailed Design
Analysis
Conceptual Design
Documentation
VISUALIZATION
Programming
building type
*commercial
*residential
sq footage
of rooms
lobby
Building Information Modeling
Fabrication
Renovation
Construction 4D/5D
Demolition
Operation and Maintenance
Construction Logistics



Today's Challenges of AEC Industry



Think of BIM as intelligent Lego

- BIM elements are fully parametric Lego blocks
- Lego blocks are [PLACEHOLDERS] for real-world product data
- All Lego blocks must be accounted for - otherwise model is incomplete







- Model is **complete** (No blocks missing)

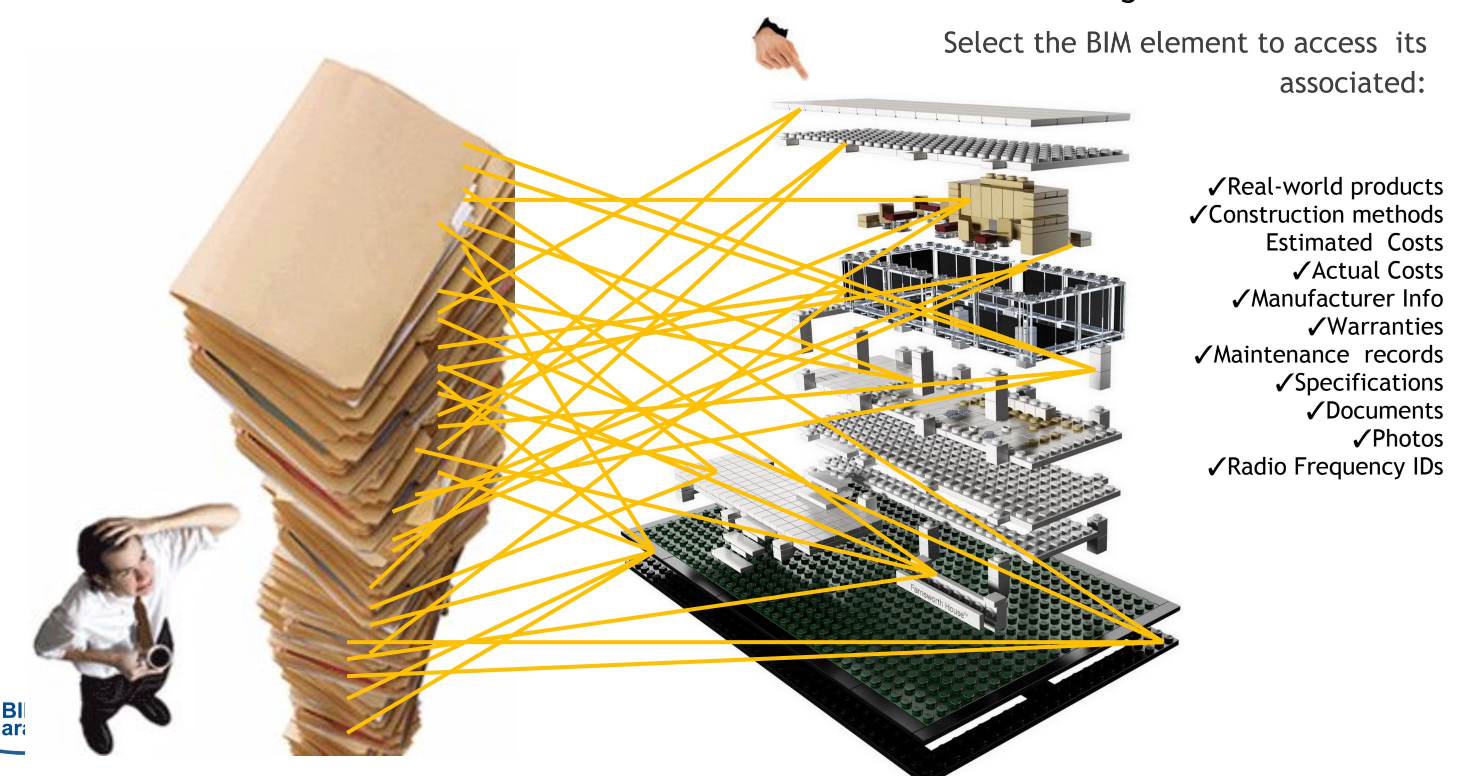






- that can store ‘unlimited’ building lifecycle data
  - **BIM = Document Management System for Buildings**
  - BIM elements can be used as **Smart Folders** for “unlimited” data storage

Select the BIM element to access its associated:

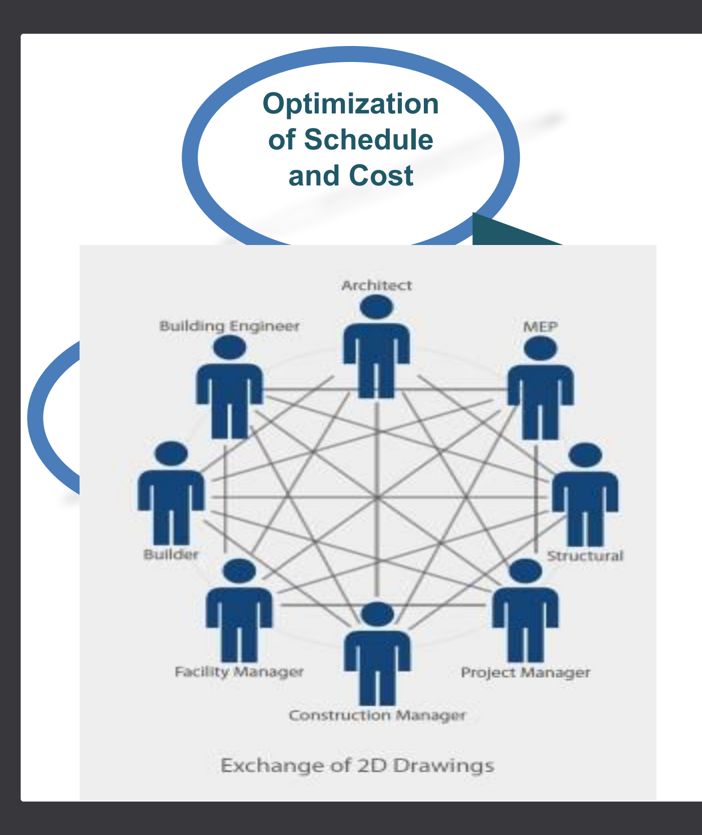


✓Real-world products
✓Construction methods
Estimated Costs
✓Actual Costs
✓Manufacturer Info
✓Warranties
✓Maintenance records
✓Specifications
✓Documents
✓Photos
✓Radio Frequency IDs

BIM Benefits

Optimization of Schedule and Cost

Coordination & Collaboration



CAD versus BIM

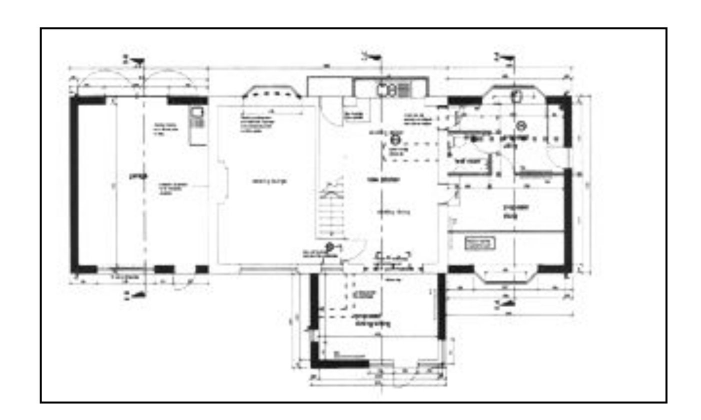


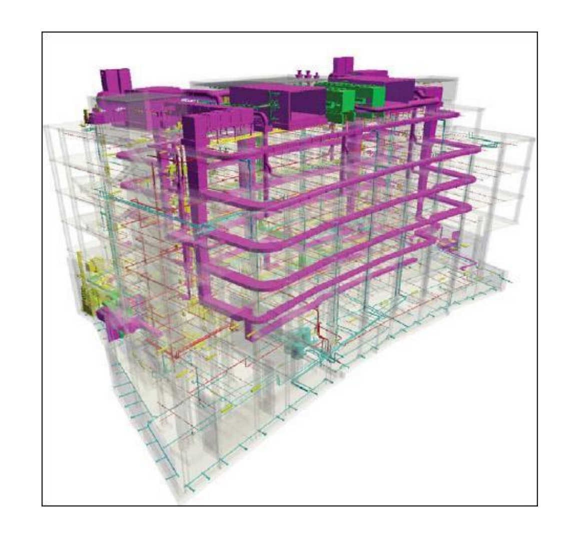
Computer Aided Design

- Primarily 2D
- Dumb graphics
- Lines, arcs, circles

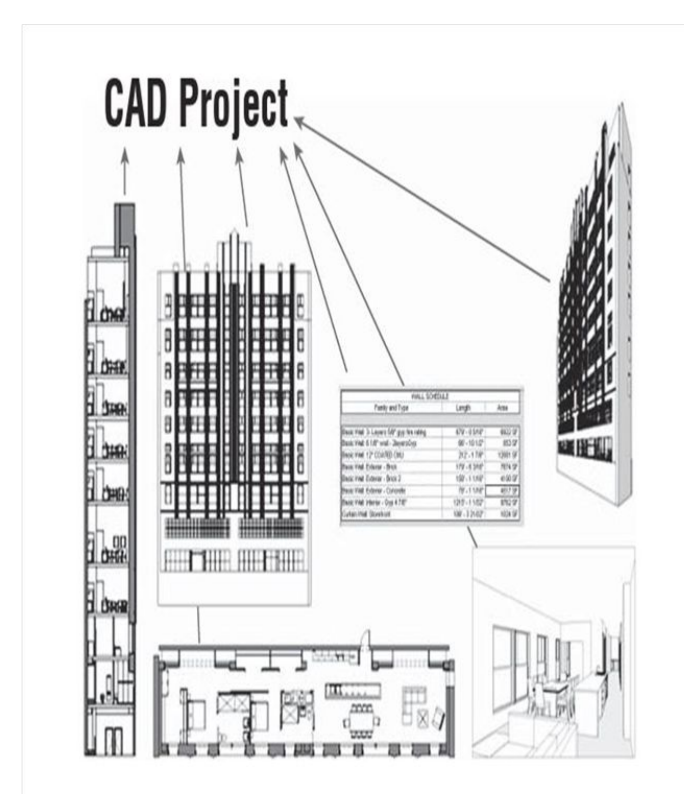
Building Information Modeling

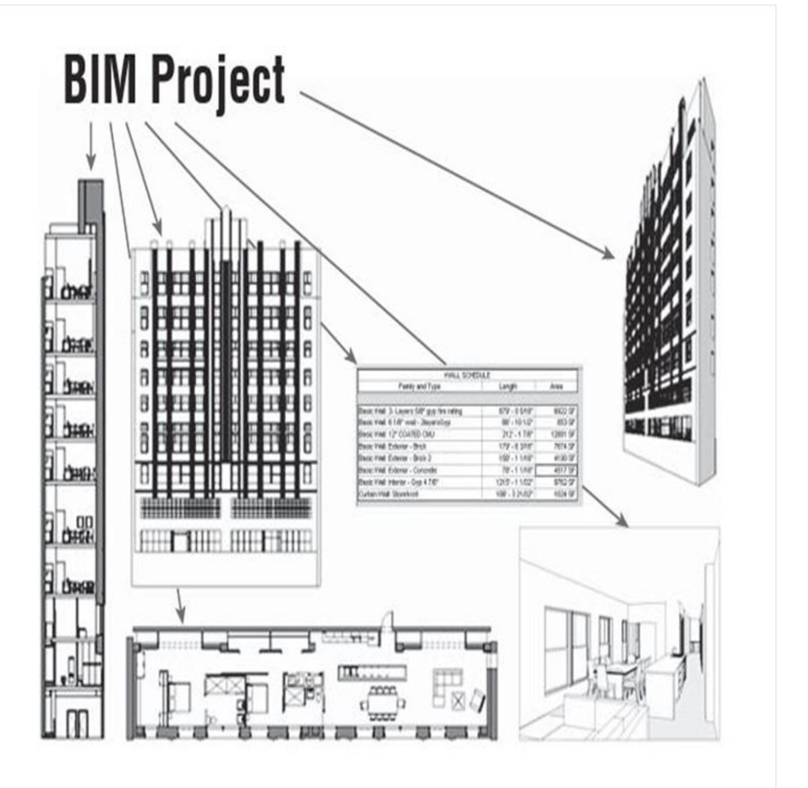
- 2D 3D 4D 5D 6D & beyond
- Intelligent objects
- Walls, windows, floors, roofs








CAD Project


BIM Project


BIM
arabia

INTEGRATED DESIGN

Integrated Design works very well with Building Information Modelling (BIM). The process for Integrated Design encourages close collaboration between the client and core design team, (a driver for projects using BIM).





Integrated Project Delivery with BIM

Integrated project delivery (IPD) is the emerging standard for early collaboration and effective decision making in the building industry today. Incorporating a building information modeling (BIM) toolset into any aspect of the IPD process enables project teams to use information in an integrated environment, increasing efficiency and enabling new ways of working that inspire more creative and sustainable designs.

Keys to Integrated Project Delivery


Involve all team members in design meetings, including contractors.


Institute building information modeling.


Facilitate collaboration.


Set up contract mechanisms that enable open collaboration.


Minimize paper-based processes, and collaborate digitally.


Check for and manage interferences between trades, digitally.


Create a culture of trust and sharing.


Communicate design ideas using 3D visualization to keep everyone aligned.

PROJECT PHASES







CONCEPTUALIZATION

The project team comes together at the earliest stage, improving accuracy of decisions. The rest of the process becomes more predictable, thus avoiding costly redesign work.

Architect: "Input from the extended project team enables me to make better design decisions early in the process."

Contractor: "I can foresee problems and reduce future delays."

Civil Engineer: "I can help with site selection so we won't run into environmental issues later."

DESIGN

Collaboration between the architect, contractor, and engineers allows for better decision making, helping to improve quality and mitigate risk.

Owner: "Careful planning will reduce waste and save money and time."

Architect: "We have a common understanding of design intent among the team. And, we can more effectively influence the sustainability performance of our designs."

IMPLEMENTATION DOCS

Precise virtual models are automatically part of the design, helping to reduce uncertainty in documents and interferences during construction.





MEP Engineer: "There are no conflicts in the field because we chose the best systems and sizing of the equipment during design."

Structural Engineer: "We were able to make the necessary analysis to a single model, saving us time and allowing us to fast track the structural design process and documentation."

Fabricator: "Working with just one model to produce steel fabrication shop-drawings allowed us to begin fabrication early."

CONSTRUCTION

Because of careful early planning, team members are able to use materials efficiently, creating less waste. Change orders are minimized, and no operational revenue is lost. Construction can be completed on schedule and on budget.



Contractor: "We've had zero interference on this project. RFI's were reduced significantly. I've never had construction go so smoothly."

OWN / OPERATE

Owners can enjoy better quality assurance on their completed project and are provided with a complete virtual building for operational and renovation purposes.

Owner: "My building project was finished on time and on budget."

Tenant: "I can tell our needs were taken into account when the building was designed."

TOOLS




Conceptualization: Revit® Architecture, Revit® Structure, Revit® MEP, AutoCAD® Civil 3D®, Autodesk® 3ds Max® Design, Autodesk® Maya®, Autodesk® Inventor™, Autodesk® Impression, Autodesk Collaborative Project Management

Design: Revit® Architecture, Revit® Structure, Revit® MEP, AutoCAD® Civil 3D®, Autodesk® 3ds Max® Design, Autodesk® Design Review, Autodesk® NavisWorks®, Autodesk® Quantity Takeoff, Autodesk Collaborative Project Management

Implementation Docs: Revit® Architecture, Revit® Structure, Revit® MEP, AutoCAD® Civil 3D®, Autodesk® Design Review, Autodesk® NavisWorks®, Autodesk® Quantity Takeoff, Autodesk® Inventor™, AutoCAD®, Autodesk Collaborative Project Management

Construction: Autodesk® NavisWorks®, Revit® Architecture, Revit® Structure, Revit® MEP, AutoCAD® Civil 3D®, Autodesk® Inventor™, Autodesk® Design Review, Autodesk Collaborative Project Management

Own / Operate: Autodesk® FMDesktop™, Autodesk® Design Review, Autodesk Collaborative Project Management

Autodesk

XPLANATIONS™ by XPLANE®


BIM
arabia

Data modeling



The Shift Towards BIM ?

Reasons Why Make the Shift?

- You can see this clearly in the international market. Since 2016, the United Kingdom has mandated the use of BIM for many projects. Singapore operates an e-submissions system that requires firms to use BIM for projects of a certain size. In France, the government committed itself to building 500,000 houses using BIM.
- Australia has been a little slow off the mark when it comes to BIM mandates. But they're coming. Queensland introduced a new mandate in 2017 that requires the use of BIM for many infrastructural projects. It's likely that other states will introduce similar mandates in the coming years.
- So, what happens if you don't make the switch? Simply put, you lose access to the work. Such mandates will result in the refusal of pitches that don't follow the BIM framework. As a result, Building Information Modelling is no longer an optional framework. For many firms, it's becoming a requirement.



The Shift Towards BIM ?

Reasons Why Make the Shift?

- Think about the way you currently design models. You'll have a base model that just showcases the design. Then, you have to build several more models and 2D drawings. Each of this shows a different subset of information. You may have a 2D floor plan to go along with the 3D model. You may also rework your 3D model constantly to demonstrate a structure's thermal properties or other information.
- These processes require you to rework your model when you get new information. That's a lot of time spent on doing things that you've already done.
- The use of a single model in BIM changes all of that. The model contains all of the information needed for the project. Project stakeholders and designers don't have to keep going back and forth to rework things. BIM eliminates redundancy, which makes you more efficient. The end result is time saved that you can use elsewhere.



The Shift Towards BIM ?

Reasons Why Make the Shift?

- Building Information Modelling doesn’t just result in cost savings for your clients. It can also help your firm to save a lot of money.

- The lack of reworking and increased efficiency help here. Your people save time on manual tasks, which means they can use their time more effectively elsewhere. Fewer delays means you run less risk of going over budget.

- The same goes for the increased amount of accuracy that BIM creates. Having so much information available for the creation of your models means you’re less likely to make mistakes during the design process.



Truth and Lies around BIM shifting

BIM Adopting for a firm of any size is a daunting task. lists the following concerns, some that you might have heard or are familiar with:

- There is not enough time to properly train employees.
- Who within the company will lead the implementation process?
- Completing a project in Revit is more time consuming than AutoCAD.
- We will have to create new drafting standards and content libraries.
- Computer upgrades will cost too much.
- AutoCAD drawings just look better than Revit drawings.
- Revit is just a fad and it is not practical for our business.
- We have been successful creating drawings the same way for many years.

  Why change now?



Truth and Lies around BIM shifting

These are all valid concerns, and our team has often found that the success of an AutoCAD-to-Revit transition hinges on the setup and management of Revit itself. That’s why I am sharing a simplified approach to help companies and teams to become properly organized to set themselves up for a more successful delivery.



BIM Implementation Challenges

- Expertise
- Resistance to Change
- No client demand
- Not always relevant to projects worked on
- Perceived Cost



Pillars for BIM Implementation

Essential to the success of implementing BIM is a succinct and well-articulated vision from executive leadership of what the BIM business transformation will achieve for the organization, what the principle elements of the transformation are, and what this evolution will look like at various stages. This isn't just a vision statement; it is a narrative of where BIM will take the organization.





Pillars for BIM Implementation

Leaders in an organization undergoing a BIM business transformation are responsible for driving and motivating change throughout the organization. There will be peaks and troughs of energy and inspiration, and these leaders must ensure that the transformation keeps moving forward. They must tangibly connect the vision to the integrated change that takes place on the shop floor.





Pillars for BIM Implementation

The implementers of a BIM business transformation are the people working daily on the shop floor. In order to deliver on the BIM vision, changes must be integrated across business activities with clear incremental improvements at each milestone. Change is realized through new policies and strategies, organizational change management, standards and processes, and integrated technology-enablers.





How to Fit the BIM to your scale

1. Start Small
2. Look for a Pilot Project
3. Look at Your Budget
4. Enlist the Experts
5. Prepare A BIM Plan For Each Project
6. Be Careful with Modelling
7. Don't Go Back to CAD



How to Fit the BIM to your scale

8. Know What You're Getting Into
9. Create an implementation plan that sets a clear path to BIM
10. Check Your Schedule
11. Plan before Your Model
12. Figure Out How it All Links Together
13. Listen to Employees
14. Talk to Your Clients



Ways to Fail in BIM implementation

1. Lack of BIM execution plan(bxp)
2. Not using the right hardware
3. New drafting tool
4. Copy cad standards
5. Why i need training
6. No quality checks



Ways to Fail in BIM implementation

7. Why BIM manager
8. Software are costly
9. No BIM strategy
10. Starting too big
11. Poor training



The Most 12 Rules for Successfully implementation

From my Point of view the Most 12 Rules for successfully implementation are the following :

1. Get to know BIM
2. Communicate the change to your Board Management.
3. Assemble the BIM champions
4. Determine your standards.
5. Account for software and hardware needs
6. Develop a change management plan



The Most 12 Rules for Successfully implementation

From my Point of view the Most 12 Rules for successfully implementation are the following :

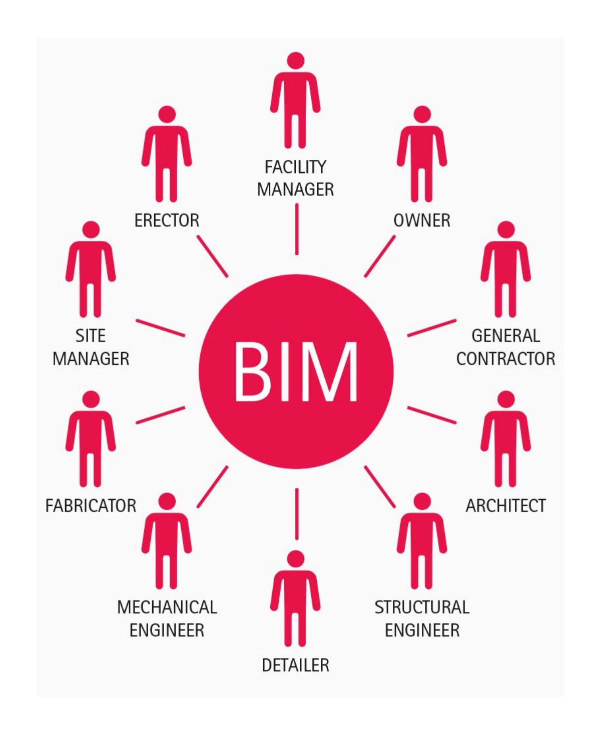
7. Start a pilot program, and train the pilot team.
8. Don’t make things too complicated
9. Always Have a Plan B
10. Find a partner
11. Train and transition other teams.
12. Expand and innovate with BIM.



Better outcomes through collaboration

- ✓ All project partners – uses a single, shared 3D model, **cultivating collaborative working relationships**.

- ✓ This ensures **everyone is focused** on achieving best value, from project inception to eventual decommissioning.





Project Control

Project Scope Management

Project Cost Estimates and Accounts

Project Schedule and Tracking

Project Resources plans and Histogram

Project Quality controls and Assurance

Project HSE plans, Deliverables and Timeline

Change Management

Communicatio n Management

Stakeholder Management

Contracts Management

Technical/ Engineering Studies incorporation in Engineering Design

Controlled Document through Document Controller

Risk Management



work breakdown structure (WBS)

- Level 1 – Project: MTB
- Level 2 – Area: Pier 1, Pier 2
- Level 3 – Subarea: Basement, Floor 1
- Level 4 – Fragnet: MEP, Structural
- Level 5 – Activity: Concrete
- Level 6 – Object: Columns, Slab Zone 5.34
- Level 7 - Operation: Rebar, Pour Concrete, Curing



TIME CONTROL

- ✓ Agreeing the design concept early in project development to eliminate late stage design changes;
- ✓ Using standard design elements when practicable;
- ✓ Resolving complex construction details before the project goes on site;
- ✓ Avoiding clashes;
- ✓ Taking advantage of intelligence and automation within the model to check design integrity and estimate quantities;
- ✓ Producing fabrication and construction drawings from the model; and Using data to control construction equipment.



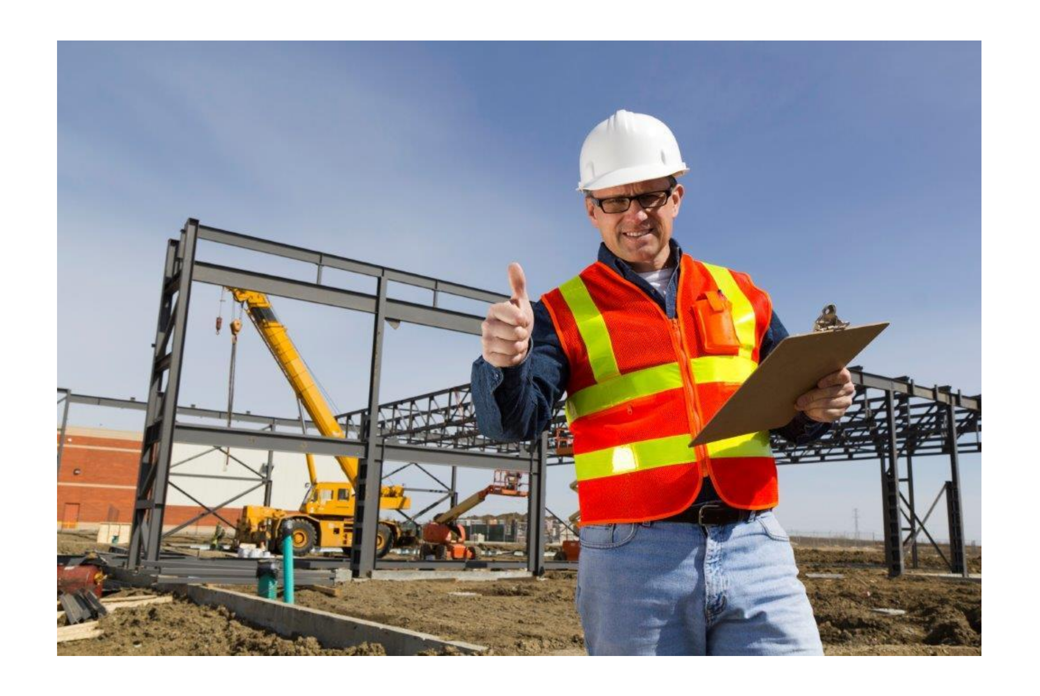


Cost estimating



Quality

- ▫ Information Exchange Specification
- ▫ Co-ordination
- ▫ Risk Management
- ▫ Issue Resolution
- ▫ Clash detection





Enhanced & optimized performance

- ✓ BIM makes possible swift and accurate comparison of different design options.
  - ➢ enabling development of more efficient, cost-effective and sustainable solutions.





Optimized solutions

- Through deployment of new generative modeling technologies, **solutions can be cost-effectively optimized** against agreed parameters.





Short-term programming and logistics planning



Greater predictability

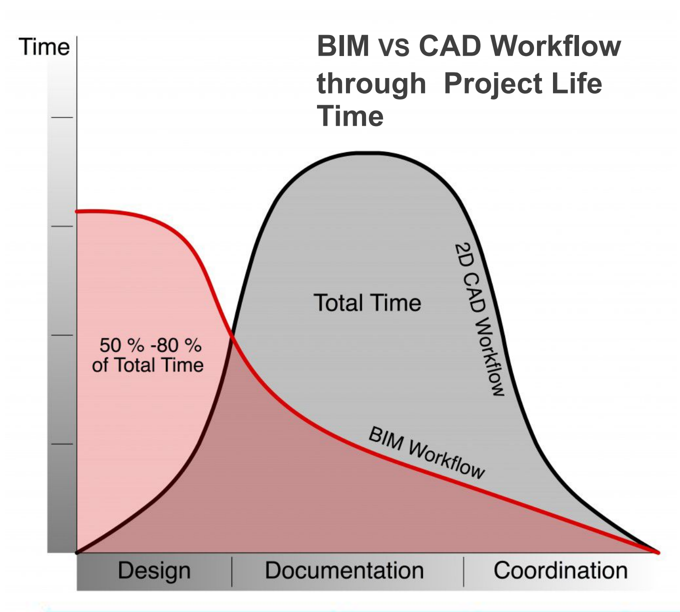
- ✓ Projects can be **visualized at an early stage** - giving owners and operators a clear idea of design intent and allowing them to modify the design to achieve the outcomes they want.

- ✓ In advance of construction, BIM also **enables the project team to 'build' the project in a virtual environment**, rehearsing complex procedures, optimizing temporary works designs and planning procurement of material, equipment and manpower.





BIM vs CAD



Task	CAD (hours)	BIM (hours)	Hours saved	Time savings
Schematic design	190	90	100	53%
Design development	436	220	216	50%
Construction documents	1023	815	208	20%
Checking and coordination	175	16	159	91%
Totals:	1,824	1,141	683	



Visual Simulation and understanding of program changes.

Innovaya Visual Simulation - C:\demo\CEME.inv

Start >> Communication >> 4D Modeling >> Help >> Use walk-through tools to explore building model...

Building Sections | Component Types | Tasks/Milestones | Resources

Construction 14% | 12/8/2002 | Project 30%

Linked · Unlinked · Partially Linked

- zzzUnassigned (8)
- Phase 1 (1186)
  - New Footing (117)
  - New GL (290)
    - Generic Objects (5)
    - Plants (9)
    - Entourage (1)
    - Lighting Fixtures (62)
    - Walls (30)
      - Type1 (1)
      - Type2 (2)
      - Generic - 200mm (2)
      - Interior - 135mm Partition (2-
      - Concrete core (6)
    - Curtian Walls (56)
    - Doors (26)
    - Ceilings (4)

Linked Tasks

ID	Task Name	
95	Install exterior ma...	
	Start	7/29/2002
	Finish	8/8/2002
	On Critical Path	Yes
94	Install exterior me...	
	Start	7/18/2002
	Finish	7/26/2002

Reload >>

Walk · Examine · Auto Fit · Reset > · Range · 12/ 8 /2002

Completed Tasks · Unstarted Tasks

ID	Task Names	Start
128	Rough-in electrical in masonry ...	6/7/2002
95	Install exterior masonry wall 1s...	7/29/2002
97	Install exterior masonry wall 2n...	8/20/2002
99	Install exterior masonry wall 3r...	9/11/2002
101	Install exterior masonry wall roof	10/2/2002
93	Install exterior masonry wall st...	7/12/2002
94	Install exterior metal studs 1st ...	7/18/2002
96	Install exterior metal studs 2nd...	8/9/2002
98	Install exterior metal studs 3rd ...	9/2/2002
100	Install exterior metal studs roof	9/24/2002
92	Install exterior metal studs stai...	6/3/2002
43	Cure elevator wall concrete	7/23/2002
44	Cure piers and foundations	8/22/2002

Show On-going Tasks

ID	Task Names	%Done	Start	Finish
129	Rough-in electrical in drywall ...	54.29%	11/20/2002	12/24/2002
142	Install duct in building chase 1...	27.27%	12/6/2002	12/16/2002
117	Install interior stud walls and d...	35.71%	12/4/2002	12/17/2002
104	Lay masonry at core, mechani...	77.14%	11/12/2002	12/16/2002
135	Rough-in plumbing in drywall ...	54.29%	11/20/2002	12/24/2002
62	Form 2nd floor including all flo...	42.86%	12/6/2002	12/12/2002

Resource Name	Crews
Electric Contractor	0
HVAC Contractor	0
Drywall Contractor	0
Masonry Contractor	0
Plumbing Contractor	0
G.C. Labor Crew	0
G.C. Rough Carpenter Crew	0
Total Crews	**0**



Fits first time

- ✓ **Integrating multidisciplinary design inputs** using a single 3D model allows
  - ➢ interface issues to be identified and resolved in advance of construction
  - ➢ **eliminating the cost and time impacts of redesign**.
- ✓ The model also enables new and existing assets to be integrated seamlessly.





Clash detection



Reduced waste

The Construction Industry Institute estimated the percentage of waste and ineffective business approximately about 57% of the cost of construction, as well as the cost of the interference between the architecture engineering construction software is estimated about $15.8 billion in all fields over the past years to adopt interchangeable software. This money could be used to make the projects more efficient and sustainable, if only it had been invested in staff training and construction of the new technologies. So the construction industry was waiting and needing BIM

- ✓ Exact quantity take-offs mean that material are not over-ordered.
- ✓ Precise programme scheduling enables just-in-time delivery of material and equipment, reducing potential for damage.
- ✓ Use of BIM for automated fabrication of equipment and components enables more efficient materials handling and waste recovery.





Procurement BIM

Designer
Engineer
Estimator
Site Engineer
Purchaser
Accountant

PROCUREMENT BIM

Procurement Agent
Material Manufacturer
Information Provider



BIM : RETURN ON INVESTMENT

Five Top-Rated Positive Impacts of BIM		
	Respondent Type	**% Rating High or Very High**
Improved Constructability of Final Design	Contractors	**74%**
Increased Owner's Understanding of Proposed Design Solutions	Owners	**73%**
Improved Quality / Function of Final Design	Engineers	**71%**
Generated Better Construction Documents	Owners	**70%**
Improved Ability to Plan Construction Phasing and Logistics	Owners	**70%**

- Dodge Data & Analytics



BIM BAM BOOM savings

Up to 30% saving

Cost benefits over 50 years

Building Information Model	Building Assembly Model	Building Operation & Optimisation Model
BIM	BAM	BOOM!
1$	20$	60$
Design	Build	Manage

Benefit

Time



Challenges

Some challenges are related to adoption, others related to implementation. Some challenges relate to both









Challenges..

Technical

BIM knowledge	Rarity of trained staff. Most trainings focus on tools rather on concepts & processes
Implementation controls	Lack of success criteria, & comparative studies against CAD based workflow
Local Codes & Standards	No unified standards/codes to ensure proper adoption and implementation
Technology limitations	Design tools still fall short in many areas (unlike the intelligence of *vertical projects'* design tools)
IT Environment	Supporting HW/SW infrastructure, data interoperability, exchange policies, cloud computing, security



Challenges



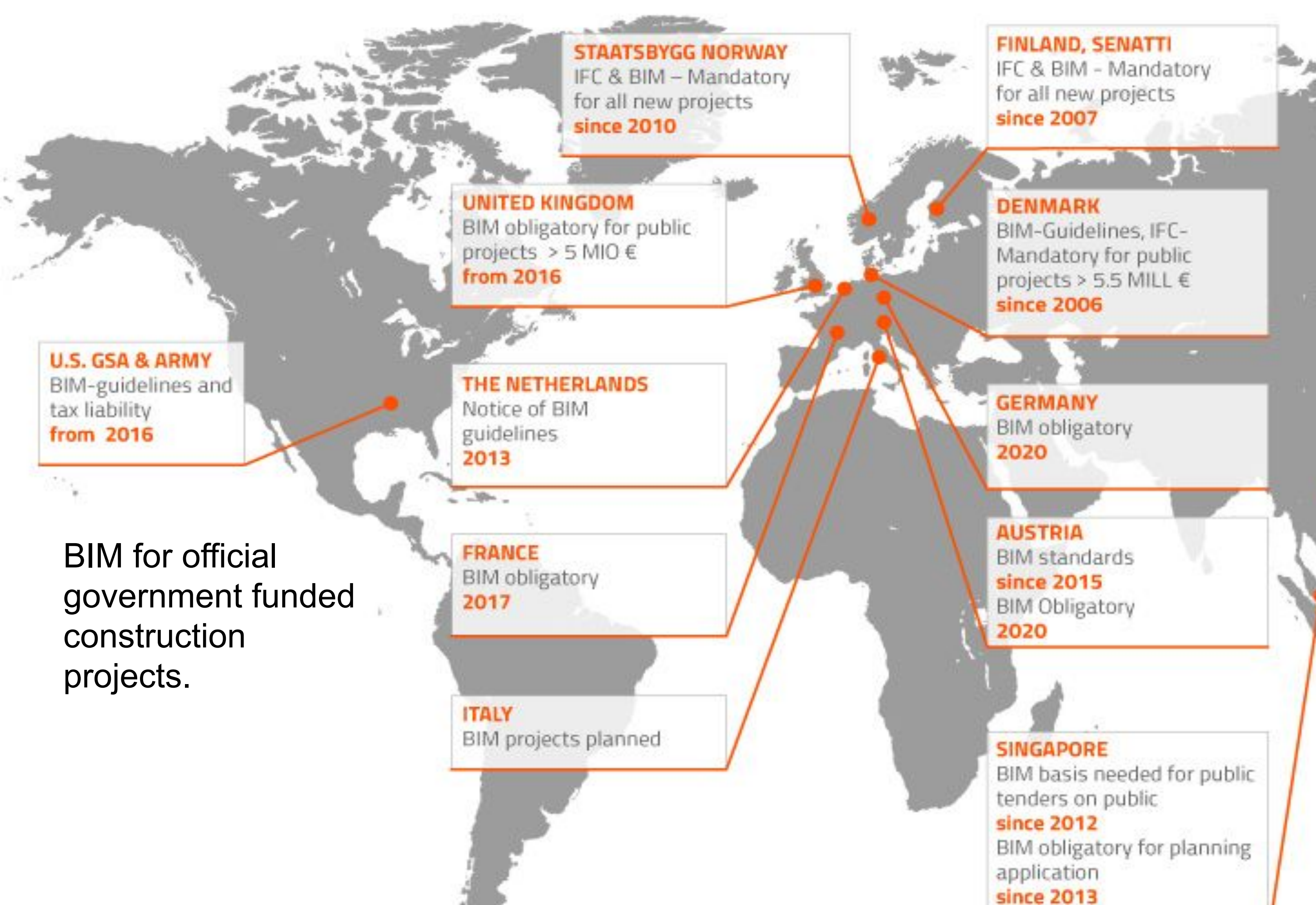
Strategic goals	Is it aligned with the organization objective?
National mandating	Establish client/market requirement, Integrated Project Delivery environment
Parametric analysis	No clear data for BIM efficiency. Lack of performance assessment methods
Procurement & legal	Where does this process fit in BoQ? What product to sell? Model ownership & liability
RoI	Will BIM really pay back? Will it help making more money
Reduced margins	Scope creeps, premature workflows, lack of ongoing support may lead to more fruitless work



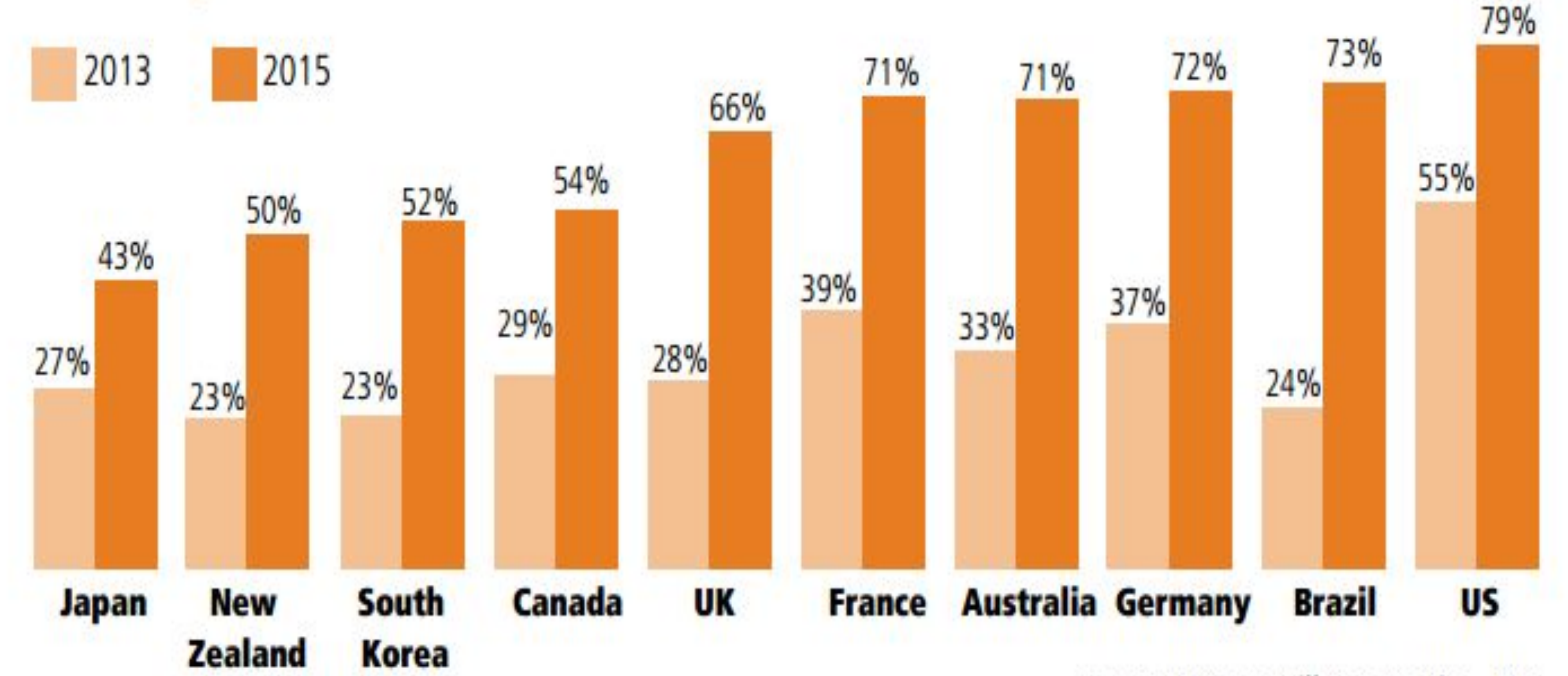
Challenges..

Social	
Thorough management	BIM is not about the final product, it is about the path how to reach
Reluctance	*“We are producing already, BIM might be an unnecessary overkill!”*
Change management	When adoption fails due to poor transition planning
Associated risks	Impact on business, slower production rate, losing CAD experience





BIM for official government funded construction projects.



Percentage of contractors at high/very high BIM implementation levels
2013
2015
27%
43%
23%
50%
23%
52%
29%
54%
28%
66%
39%
71%
33%
71%
37%
72%
24%
73%
55%
79%
Japan
New Zealand
South Korea
Canada
UK
France
Australia
Germany
Brazil
US
Source: McGraw Hill Construction, 2013



Building Information Modelling (BIM) Task Group

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"This Government's four year strategy for BIM implementation will change the dynamics and behaviours of the construction supply chain, unlocking new, more efficient and collaborative ways of working. This whole sector adoption of BIM will put us at the vanguard of a new digital construction era and position the UK to become the world leaders in BIM."

Francis Maude
Minister for the Cabinet Office

Welcome to the BIM Task Group Website

www.bimtaskgroup.org/







Ref: 812/02/02/1/1314482 18/11/2013

تعميم إلى جميع المكاتب الاستشارية وشركات المقاولات العاملة في إمارة دبي

تعميم رقم (196)

بشأن تطبيق نموذج ال (Building Information Modeling – BIM)

انسجاماً مع جهود بلدية دبي للارتقاء بمستوى الخدمات من خلال تطوير الأنظمة والقوانين لمواكبة أرقى المعايير العالمية، والاستغلال الأمثل للتقنيات الحديثة، وماشهدته صناعة البناء من تطور في مجالات التخطيط والتصميم والتنفيذ والتشغيل والادارة وصولاً الى مرحلة الهدم، والتقدم الهائل في البرامج الالكترونية المتخصصة في مجال انتاج وضبط وتنظيم العمل الهندسي، والنجاح الذي حققه تطبيق نموذج (Building Information Modeling – BIM) وامكانياته التي تمكن من تطوير أدوات ووسائل انتاج المبنى بطريقة تضمن تحسين مستوى الجودة والتنظيم والتواصل بين العاملين في كافة مراحل المشروع بالاضافة لتخفيض الوقت والكلفة وتوحيد المواصفات والمعايير الهندسية المطبقة وتسهيل اعداد جداول الكميات والبرامج المالية بدرجة عالية من الدقة، فقد تقرر تطبيق نموذج ال (BIM) للأعمال المعمارية والالكتروميكانيك (MEP) كمرحلة أولى على:

1- المباني التي يزيد ارتفاعها عن (40) طابق

2- المباني التي تزيد مساحتها عن (300 ألف قدم مربع).

3- المباني التخصصية كالمستشفيات والجامعات ومافي حكمها.

4- كافة المباني المقدمة عن طريق فرع مكتب أجنبي.

وذلك ابتداءاً من تاريخ 2014/1/1 ، على أن تكون المكاتب الاستشارية مسئولة قانوناً عن عملية التطبيق

آملين من الجميع التعاون لما فيه المصلحة العامة

المهندس / خالد محمد صالح

مدير ادارة المباني

بلدية دبي DUBAI MUNICIPALITY

يمكنكم الاطلاع على كافة التعاميم على الموقع الإلكتروني لبلدية دبي www.dm.gov.ae الصفحة الرئيسية – اعمال البلدية – التخطيط والبناء – تعاميم البناء

EXPO 2020 إكسبو
دبي، الإمارات العربية المتحدة
DUBAI, UNITED ARAB EMIRATES

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رؤيتنا: بناء مدينة متميزة تتوفر فيها استدامة رفاهية العيش ومقومات النجاح
Our Vision : Creating an excellent city that provides the essence of success and comfort of sustainable living.



BIM Implementation and Adoption

Evolution towards a new process

59

EFFORT/EFFECT

Current

BIM

1 Ability to impact cost and functional capabilities
2 Cost of design changes
3 Traditional design process
4 Preferred design process

PD SD DD CD PR CA OP

TIME

Graphic originated by Patrick MacLeamy, AIA / HOK

KEY

PD: Pre-design
SD: Schematic design
CD: Construction decomentation
PR: Procurement
CA: Construction Administration
OP: Operation



BIM Implementation and Adoption

Go Slow and steady

1. Current Capability - your organization pre-BIM
2. Desired Capability - your capabilities having fully implemented BIM
3. Expected Path - the path most organizations expect to take: software = desired capability
4. Actual Curve - an unavoidable learning curve that puts additional stress on organizational resources
5. Optimal Curve - with proper change management strategy, the path to sustainable BIM adoption



Learning /J-Curve

BIM Implementation and Adoption

Merit of BIM at early phase

Work Load

BIM

Learning

Traditional

Skill up

Project Start

Design Deadline

Time

Nikken Sekkei Press Meeting
March 26, 2014

MacLeamy Curve



BIM Implementation and Adoption

5 Stages of BIM

1. **Initial Excitement**

   “Wow, Look what I can do with this thing!”

2. **First Bump**

   “Why won’t it do what I want?
   …It was easy in CAD!”

3. **Creamy Middle**

   “Things are going smoothly now”

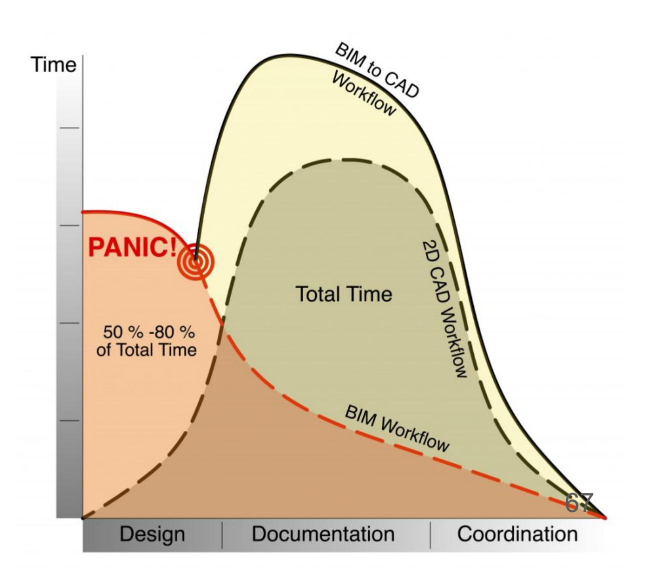
4. **!!ﬂ◊*¥×¢∆∑??!**



   “Why won’t it do what I want?
   …It was easy in CAD!”

5. **Enlightenment**

   “Things really click. You understand why things happen in the model, how to control them and how to avoid problems”





BIM

Collaboration

CAD/ Model Management

CAPEX Information Management

OPEX Information Management

Information Exchange

Information Security

Better Outcomes

Information definition standards

Eight Pillars of BIM Wisdom

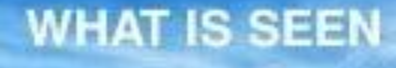


BIM IMPLEMENTATION

- Input: training resources
- Output: number of staff trained
- Outcome: extent of project stages conducted in BIM
- Impact: ability to win BIM project contracts



BIM Implementation Process - Evaluate







3D Visualisations
Coordination Dwg's
Basic Quantities

Software
Hardware
Training

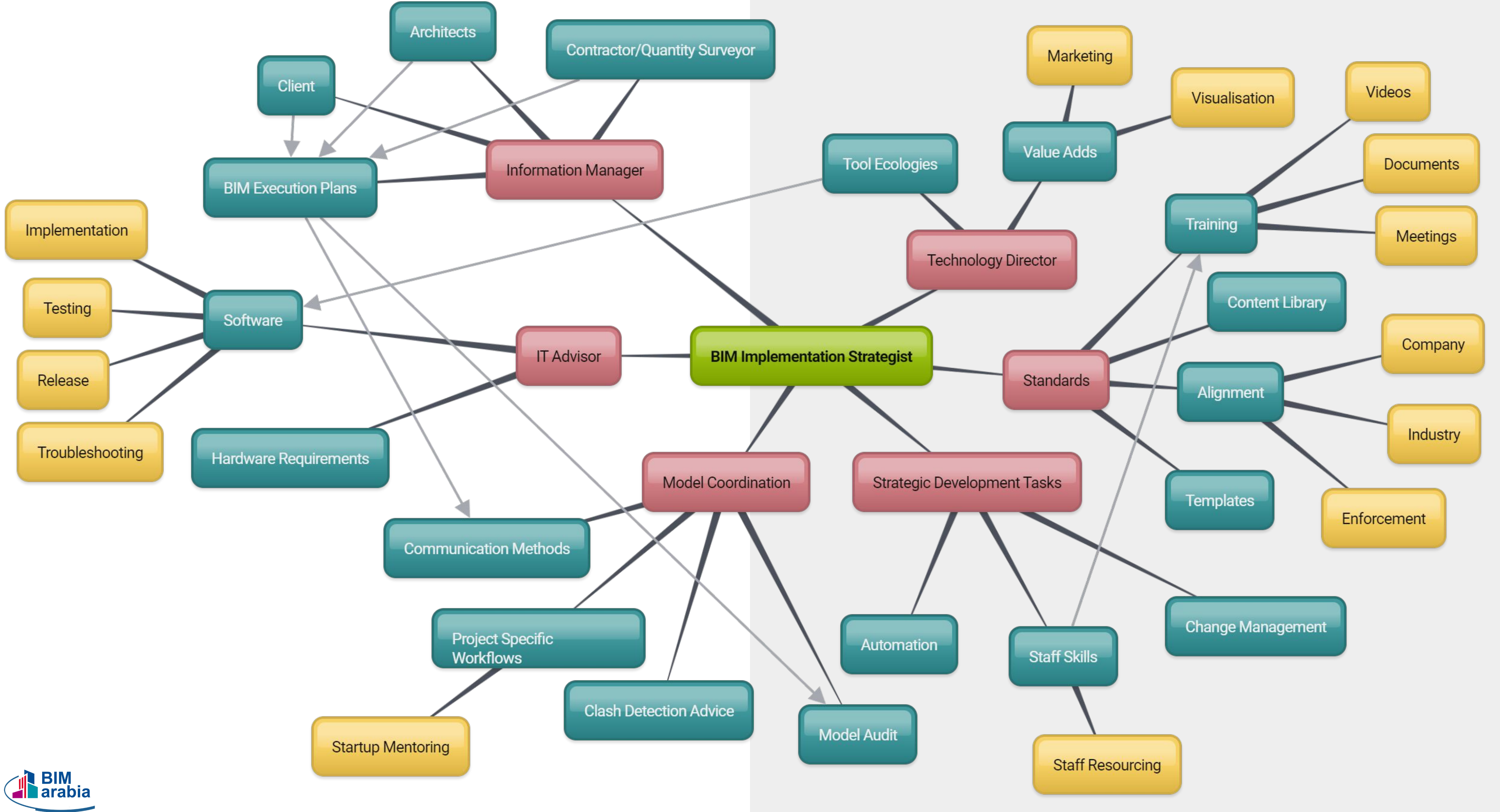
BIM Deliverables

BIM Requirements

Thermal Studies
Lighting Analysis
Structural Analysis
Constructability
Prefabrication
Asset Tracking
BIM/GIS Overlap
Laser Scanning
Field BIM
Other.............

Standards
Workflows
Processes
Change Resistance
Role Mutation
Level of Detail
CDE
Collaboration
Contracts
Other.............

WHAT IS HIDDEN


Architects
Contractor/Quantity Surveyor
Client
Information Manager
BIM Execution Plans
Implementation
Testing
Software
Release
Troubleshooting
Hardware Requirements
IT Advisor
BIM Implementation Strategist
Tool Ecologies
Technology Director
Marketing
Value Adds
Visualisation
Videos
Documents
Training
Meetings
Content Library
Standards
Company
Alignment
Industry
Templates
Enforcement
Model Coordination
Strategic Development Tasks
Communication Methods
Project Specific
Workflows
Startup Mentoring
Clash Detection Advice
Model Audit
Automation
Staff Skills
Change Management
Staff Resourcing
BIM arabia
created with www.bubbl.us

Standards & Guides



- **AIA –** (The American Institute of Architects)
- **GSA** (General Services Administration) - 3D-4D Building Information Modeling.
- **AGC** - The Contractors Guide to BIM
- **NIBS**- (National Institute of Building Sciences) -U.S. National BIM Standard
- **BSA** –Building SMART Alliance.
- **BSI** - BIM Standards



1. STRATEGY
Defines the BIM goals and objectives;assesses change readiness; and considers management and resource support.

2. BIM USES
Identifies the methods in which BIM will be implemented for generating, processing, communicating, executing, and managing information about the owner's facilities.

3. PROCESS
Describes the means to accomplish the BIM Uses by documenting the current methods, designing new processes leveraging BIM, and developing transition plans

4. INFORMATION

Documents the information needs of the organization, including the model element breakdown, level of development, and facility data.

5. INFRASTRUCTURE

Determines the technology infrastructure to support BIM including computer software, hardware, networks, and physical workspaces.

6. PERSONNEL

Establishes the roles, responsibilities, education, and training of the active participants in the BIM processes established.



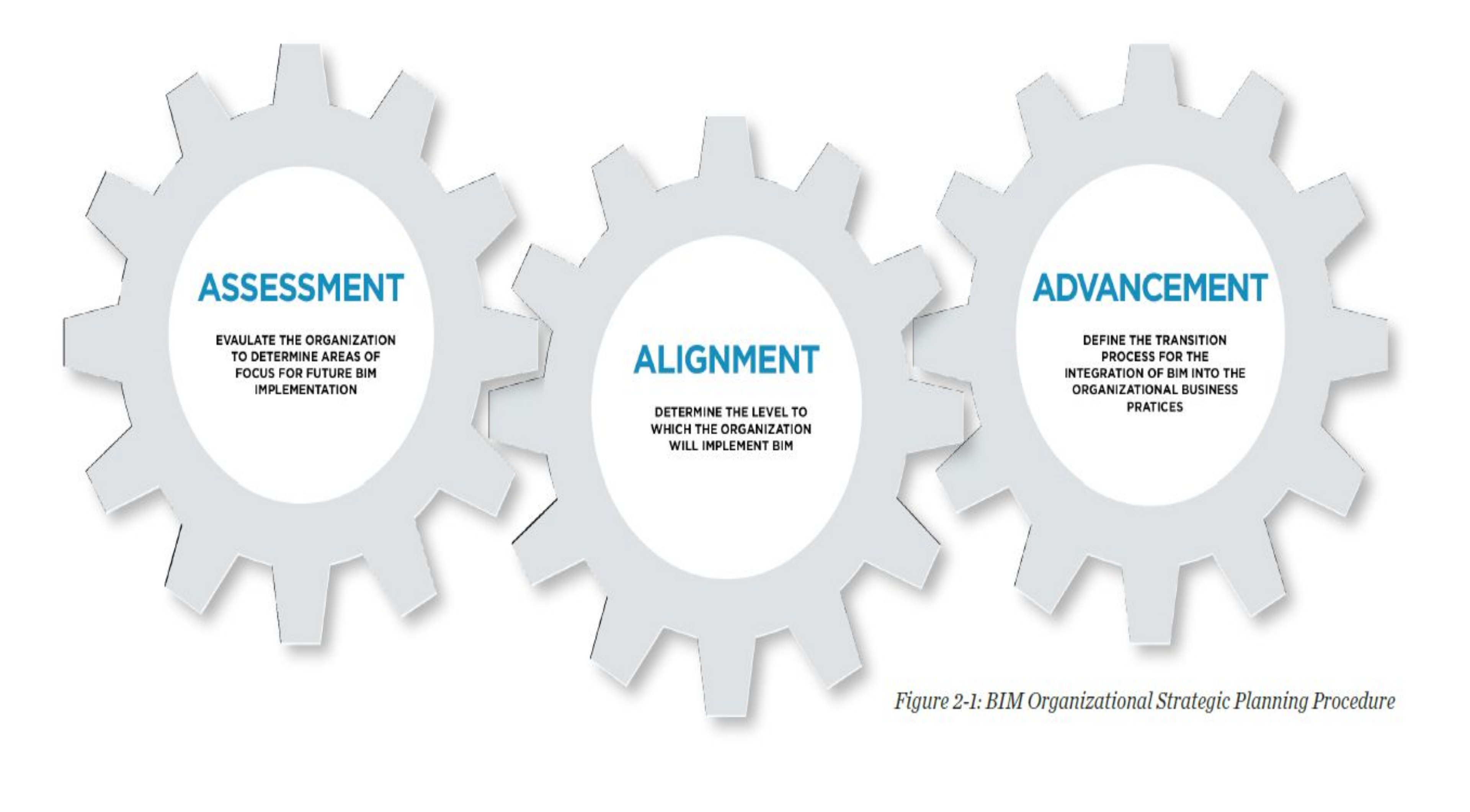


Figure 2-1: BIM Organizational Strategic Planning Procedure

technology steps A
process steps A
from PRE-BIM
policy steps A

1

technology steps B
process steps B
policy steps B

2

technology steps C
process steps C
policy steps C

3

technology steps D
process steps D
to IPD
policy steps D

Dr. Bilal Sukkar



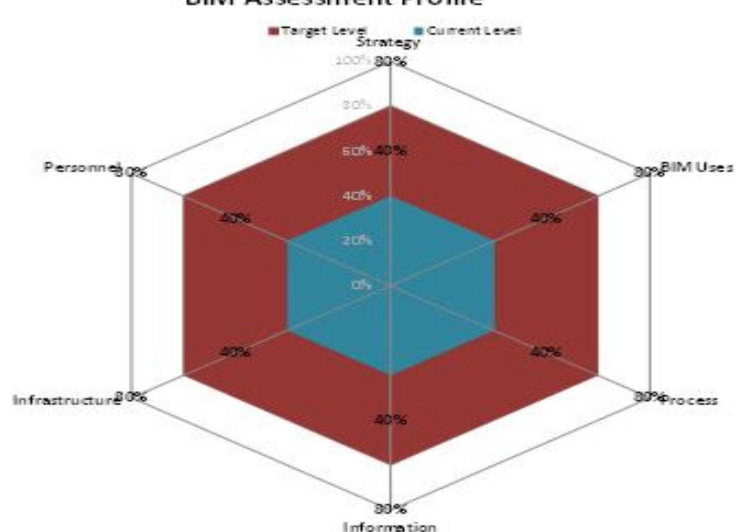
Transition Strategy

Strategy	0 Non-Existent	1 Initial	2 Managed	3 Defined	4 Quantitatively	5 Optimizing	Current	Target	Possible
Mission and Goals	No Organizational Mission or Goals C	Basic Organizational Mission Established	Established Basic Organizational Goals T	Organization Mission address purpose, services, values at minimum	Goals are specific, measurable, attainable, relevant, and timely	Mission and Goals are regularly revisited, maintained and updated (as necessary)	0	2	5
Vision and Objectives	No BIM Vision or Objectives Defined C	Basic BIM Vision is Establish	Established Basic BIM Objectives T	BIM Vision address mission, strategy, and culture	BIM Objectives are specific, measurable, attainable, relevant, and timely	Vision and Objectives are regularly revisited, maintained and updated (as necessary)	0	2	5
Management Support	No Management Support	Limited Support for feasibility study C	Full Support for BIM Implementation with some Resource T	Full support for BIM Implementation with Appropriate Resource Commitment	Limited support for continuing efforts with a limited budget	Full Support of continuing efforts	1	2	5
BIM Champion	No BIM Champion	BIM Champion identified but limited time committed to BIM initiative	BIM Champion with Adequate Time Commitment	Multiple BIM Champions with Each Working Group C	Executive Level BIM Support Champion with limited time commitment T	Executive-level BIM Champion working closely with Working Group Champion	3	4	5
Planning Team	No BIM Planning Committee established C	Small Ad-hoc Committee with only those interested in BIM	BIM Committee is formalized but not inclusive of all operating units T	Multi-disciplinary BIM Planning Committee established with members from all operative units	Planning Committee includes members for all level of the organization including executives	BIM Planning Decisions are integrated with organizational Strategic Planning	0	3	5

Uses	0 Non-Existent	1 Initial	2 Managed	3 Defined	4 Quantitatively	5 Optimizing	Current	Target	Possible
Project Uses	No BIM Uses for Projects identified	No BIM Uses for Projects identified	Minimal Owner Requirements for BIM	Extensive use of BIM with limited sharing between parties C T	Extensive use of BIM with sharing between parties within project phase	Open sharing of BIM Data across all parties and project phases	3	3	5
Operational Uses	No BIM Uses for Operations identified	Record (As-Built) BIM model received by operations C	Record BIM data imported or referenced for operational uses T	BIM data manually maintained for operational uses	BIM data is directly integrated with operational systems	BIM data maintained with operational systems in Real-time	1	2	5

Process	0 Non-Existent	1 Initial	2 Managed	3 Defined	4 Quantitatively	5 Optimizing	Current	Target	Possible
Project Process	No external project BIM Processes Documented C	High-level BIM Process Documented for Each Party	Integrated High Level BIM Process Documented T	Detailed BIM Process Documented for Primary BIM Uses	Detailed BIM Process Documented for all BIM Uses	Detailed BIM Process Documented and Regularly Maintained and Updated	0	2	5
Operation Processes	No internal organizational BIM Processes Documented C	High-Level BIM Process Documented for each operating unit	Integrated High level organizational Process documented T	Detailed BIM Process Document for primary organizational Uses	Detailed BIM Process Documented for all BIM Uses	Detailed BIM Process Documented and Regularly Maintained and Updated	0	2	5

Planning Element	Description	Level of Maturity						Current Level	Target Level	Total Possible
Strategy	The Mission, Vision, Goals, and Objectives, along with management support, BIM Champions, and BIM Planning Committee.	0 Non-Existent	1 Initial	2 Managed	3 Defined	4 Quantitatively Managed	5 Optimizing	10	20	25
Organizational Mission and Goals	A mission is the fundamental purpose for existence of an organization. Goals are specific aims which the organization wishes to accomplish.	No Organizational Mission or Goals	Basic Organizational Mission Established	Established Basic Organizational Goals	Organization Mission address purpose, services, values at minimum	Goals are specific, measurable, attainable, relevant, and timely	Mission and Goals are regularly revisited, maintained and updated (as necessary)	2	4	5
BIM Vision and Objectives	A vision is a picture of what an organization is striving to become. Objectives are specific tasks or steps that when accomplished move the organization toward their goals	No BIM Vision or Objectives Defined	Basic BIM Vision is Established	Established Basic BIM Objectives	BIM Vision address mission, strategy, and culture	BIM Objectives are specific, measurable, attainable, relevant, and timely	Vision and Objectives are regularly revisited, maintained and updated (as necessary)	2	4	5
			Limited Support for feasibility study	Full Support for BIM Implementation with Some Resource Commitment	Full support for BIM Implementation with Appropriate Resource Commitment	Limited support for continuing efforts with a limited budget	Full Support of continuing efforts	2	4	5
			BIM Champion Identified but limited time committed to BIM initiative	BIM Champion with Adequate Time Commitment	Multiple BIM Champions with Each Working Group	Executive Level BIM Support Champion with limit time commitment	Executive-level BIM Champion working closely with Working Group Champion	2	4	5
...ied			Small Ad-hoc Committee with only those interested in BIM	BIM Committee is formalized but not inclusive of all operating units	Multi-disciplinary BIM Planning Committee established with members from all operative units	Planning Committee includes members for all level of the organization including executives	BIM Planning Decisions are integrated with organizational Strategic Planning	2	4	5
...t			1 Initial	2 Managed	3 Defined	4 Quantitatively Managed	5 Optimizing	4	8	10
			Teams using BIM without requirement	Minimal Owner Requirements for BIM	Extensive use of BIM with limited sharing between parties	Extensive use of BIM with sharing between parties within project phase	Open sharing of BIM Data across all parties and project phases	2	4	5
...d			Record (As-Built) BIM model received by operational	Record BIM data imported or referenced for operational uses	BIM data manually maintained for operational uses	BIM data is directly integrated with operational systems	BIM data maintained with operational systems in Real-time	2	4	5
...t			1 Initial	2 Managed	3 Defined	4 Quantitatively Managed	5 Optimizing	4	8	10
...BIM ...ented			High-level BIM Process Documented for Each Party	Integrated High Level BIM Process Documented	Detailed BIM Process Documented for Primary BIM Uses	Detailed BIM Process Documented for all BIM Uses	Detailed BIM Process Documented and Regularly Maintained and Updated	2	4	5
...ented			High-Level BIM Process Documented for each operating unit	Integrated High level organizational Process documented	Detailed BIM Process Document for primary organizational Uses	Detailed BIM Process Documented for all BIM Uses	Detailed BIM Process Documented and Regularly Maintained and Updated	2	4	5
		Level of Maturity						Current Level	Target Level	Total Possible
...t			1 Initial	2 Managed	3 Defined	4 Quantitatively Managed	5 Optimizing	6	12	15
...el ...l			Organizational Model Element Breakdown defined but not uniform with in entire organization	Organizational Model Element Breakdown is uniform within the organization	Organizational Model Element Breakdown aligned with industry standards	Organizational Model Element Breakdown updated along with industry standards	Organizational modifications to industry standard model element breakdown are balloted for inclusion in industry standards	2	4	5
...l of			LOD defined but not standardized with the entire organization	LOD standardized within the organization	Organizational LOD standards aligned with industry standards	Model View Definitions & Information Delivery Manuals are used to define Level of Development	Organizational modification to MVDs and IDMs are balloted for inclusion in industry standards	2	4	5
...ty			Facility Data defined but not internally standardized	Facility data defined and standardized within the organization	Organizational Facility Data attributes aligned with industry standards	Facility data attributes aligned with open standards	Facility data attributes updated with open standards	2	4	5
			1	2	3	4 Quantitatively...	5			



Organizational BIM Assessment Profile			
BIM Planning Element	Current Level	Target Level	Total Possible
Strategy	10	20	25
BIM Uses	4	8	10
Process	4	8	10
Information	6	12	15
Infrastructure	6	12	15
Personnel	10	20	25
Totals	36	72	90



Team Evaluation

Score	1	2	3	4
BIM Project Execution Plan Experience	Team Has No BIM Experience	Team Has Completed Discrete BIM Uses but has Not Composed a Plan	Team Has Assisted in BIM Planning	Team Has Led BIM Execution Planning on Projects
Electronic Collaboration Experience	Team Has Limited Electronic Collaboration Experience	Team Utilizes Electronic Methods for Communication such as (RFI's, Submittals, Change Orders, Etc.)	Team Utilizes Internet Based Communication Tools but Does not Share Model	Team Shares BIM Model and Utilizes Real Time Communication Tools
BIM Uses	Team Has No BIM Experience	Team Has Used BIM for Discrete Uses During One Phase of the Project	Team Has Used BIM on Multiple Stages of the Project	Team Uses BIM Uses Throughout All Stages of the Project
Technical Capabilities	Team Hires 3rd Party to Perform BIM Uses	Team Has Internal Staff to Perform Some BIM Uses	Team Has Internal Staff to Perform All BIM Uses	Team Has Internal Staff to Develop New BIM Uses



CHANGE MANAGEMENT

Creating climate for change

- Define urgency for change - e.g. to meet BIM e-submissions or new project procurement requirements
- Define clear vision, goals and programme
- Understand key risks and success factors
- Formulate change strategies and levers



CHANGE MANAGEMENT

- Engaging and enabling the change
  - Communication for buy-in o Communicate the mandate for change clearly and frequently
  - Share success stories in practice workshops
  - Solicit and address implementation issues from the ground
- Enabling actions
  - Provide training and resources
  - Acquire equipments and software
  - Define BIM standards



CHANGE MANAGEMENT

- Implementing and sustaining the change (12 – 24 months and beyond)
  - Propagation (from project to project or team to team)
  - Setup quick start template for new teams or projects to follow
  - Set up a progression path for teams to develop in-depth knowledge
- Making it stick
  - Define clear ownership and accountability
  - Set up reward system
  - Incorporate BIM practices as part of the organisation's ISO processes



BIM ENVIRONMENT (HARDWARE AND SOFTWARE)

- a. List of commonly used software for each task.
  - BIM authoring software
  - BIM reviewing software
  - BIM Coordination software
  - Analysis software
  - Others
- b. Hardware that can run each software with a sizable model comfortably
  c. Document management system or project coordination workspace and protocol to house, manage and share the BIM models created within the organization and with external project partners.



BIM

- AUTODESK Revit

- Renders and Walkthro
- solar Study
- Shop Draw
- 3D Modelin

Revit MEP



BIM



- AUTODESK Navisworks

- 4D Simulations



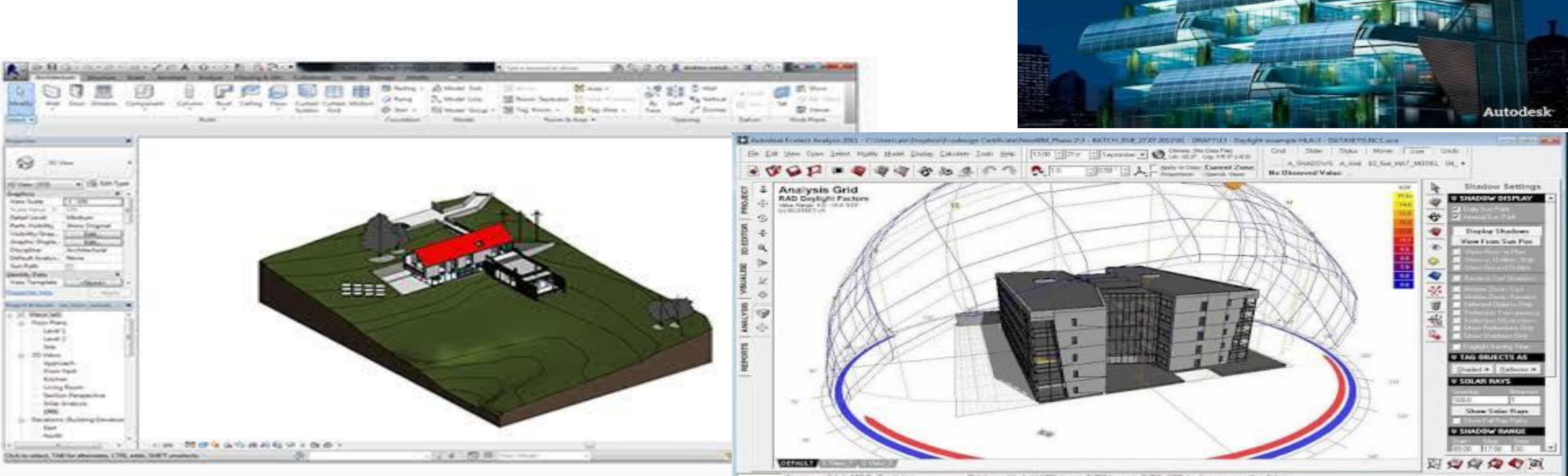
BIM

- AUTODESK Ecotect

- Environmental Analysis

Autodesk
Ecotect™ Analysis 2010

Visualize Sustainable Design.

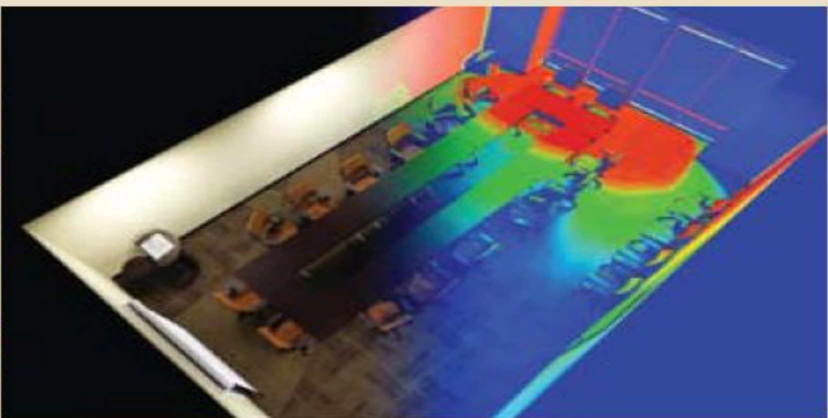


BIM

- AUTODESK Green Building Studio







Technical College community room rendering showing daylight analysis (above); Cascadia Center for Sustainable Design and Construction (left)

BIM


AUTODESK
ROBOT STRUCTURAL
ANALYSIS PROFESSIONAL
2015


TEKLA
Structures


Bentley
Sustaining Infrastructure




GRAPHISOFT
ARCHICAD


BIM
arabia

BIM QUALITY ASSURANCE

- Modelling Validation (visual check)
  - Ensure that the model is created accordingly to the modelling guidelines in the BIM standard
- Dataset Validation (adopt standard objects)
  - Ensure that the dataset are populated with correct data.
- Interference Validation (computer-assisted)
  - Detect any clash between building component using a Clash Detection software
  - Detect sufficient space clearance between building components for installation and maintenance purposes
- Exchange Validation (visual check)
  - Ensure that model is published/received based on the exchange protocol as defined in the project execution plan



BIM PROCESS FOR PROJECT

- Preparation & Conceptual Design
- Schematic Design
- Detailed Design
- Construction
- As Built

STAGE	SUGGESTED DELIVERABLES (MEP ONLY)
1. Preparation & Conceptual Design	a. Understanding Client's Requirements b. BIM Execution Plan c. MEP Concept Report which includes simple schematic, relevant design codes and etc. d.Setup BIM Project Template, coordinate system, grids, level height,
2. Schematic Design	a. Preliminary Model based on Architectural massing models b. MEP Schematic Design Report which includes design criteria and prelim design calculation. c. Schematic Drawings
3. Detailed Design	a. Detailed Design Drawing + Model b. MEP Detailed Design Report which includes updated design criteria and design calculation c. Clash detection & resolution report between MEP model and Architect & Structure models d. Detailed cost estimate, BOQ, tender documents

STAGE	SUGGESTED DELIVERABLES (MEP ONLY)
4.Construction	a. Design Validation Report b. RFI Resolution c. Shop Drawings d. Single Services Drawings (SSD) & Combined Services Drawings (CSD) e. Detailed schedule of materials & quantities
5. As Built	a. As constructed Model & drawings b. Operation & Maintenance Manual (OMM) c. Commission reports
6. Facility Management	a. As built model

Project BIM Manager



- BIM Execution Plan
- BIM Goal and Uses
- Responsibility Matrix
- BIM Deliverables
- Delivery Schedules
- BIM Modelling
- Quality Control
- BIM Coordination



BIM Coordinator for Consultant

- Create BIM Design Models and Documentation
- Define discipline-specific BIM uses including analysis
- Coordinate between BIM modellers, design consultants and cost consultant
- Coordinate with contractor and subcontractors
- Ensure Modelling Quality Control



BIM Coordinator for Contractor

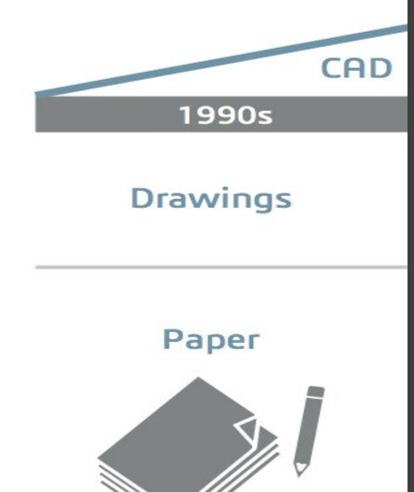
- Coordinate with design consultants and subcontractors
- Study tender documents
- Review Design Models and Fabrication Models and Drawings
- Use BIM for coordination, sequencing, constructability and cost studies, and field use
- Create construction and as built models
- Ensure Modelling Quality Control



What do we need to achieve?

1. Higher quality, more reliable design information
2. Greater client certainty/predictability (time, cost, quality) earlier
3. Better visualisation
4. Better multi-disciplinary collaboration
5. Quicker, more consistent and easier coordination of design documentation
6. Earlier, accurate, complete procurement data ('smart' BoQs); elimination of waste and rework
7. Better construction and project management ('build it once virtually, then build it for real')
8. Better 'as-built', whole-life information for O&M
9. Reduced Risk Factor during Construction
10. Best Control of Clash Detections
11. Increased Productivity
12. Saving Time and faster delivery.
13. Whole Life asset management
14. Continual Improvement

BIM

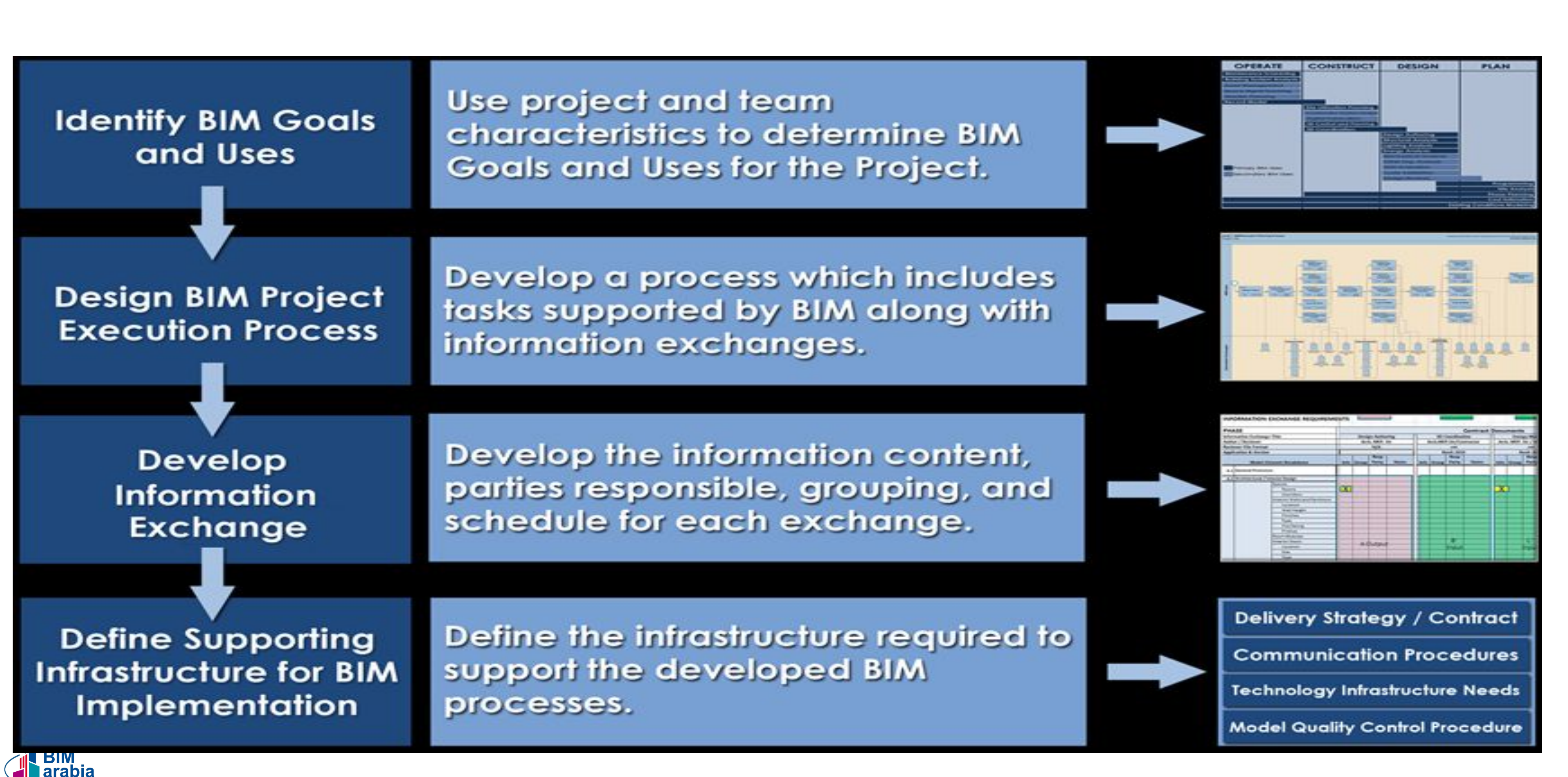

BIM Level 0
Maturity
CAD
1990s
Formats
Drawings
Paper
Tools

BIM Execution Plan

- Set clear goals & objectives across organization & teams
- Increase accountability and productivity
- Standardize your communication methods
- Define roles and responsibilities
- Bind all parties early in the RFP process
- Control your project costs, schedule, scope and quality





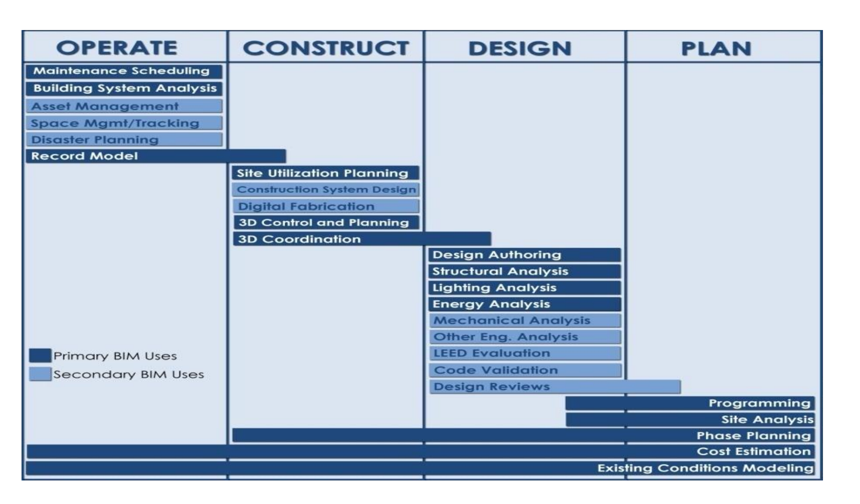

Identify BIM Goals and Uses
Use project and team characteristics to determine BIM Goals and Uses for the Project.
Design BIM Project Execution Process
Develop a process which includes tasks supported by BIM along with information exchanges.
Develop Information Exchange
Develop the information content, parties responsible, grouping, and schedule for each exchange.
Define Supporting Infrastructure for BIM Implementation
Define the infrastructure required to support the developed BIM processes.
OPERATE
CONSTRUCT
DESIGN
PLAN
Delivery Strategy / Contract
Communication Procedures
Technology Infrastructure Needs
Model Quality Control Procedure
BIM arabia



Design BIM Project Execution Process

Develop Information Exchange

Define Supporting Infrastructure for BIM Implementation



BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes	Proceed with Use
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)					YES / NO / MAYBE
				Resources	Competency	Experience			
Record Modeling	HIGH	Contractor	MED	2	2	2	Requires training and software		YES
		Facility Manager	HIGH	1	2	1	Requires training and software		
		Designer	MED	3	3	3			
Cost Estimation	MED	Contractor	HIGH	2	1	1			NO
4D Modeling	HIGH	Contractor	HIGH	3	2	2	Need training on latest software	High value to [illegible] to	YES
							Infrastructure needs	phasing co[illegible]	
								Use for Phasing & Construction	
3D Coordination (Construction)	HIGH	Contractor	HIGH	3	3	3			YES
		Subcontractors	HIGH	1	3	3	conversion to Digital Fab required	Modeling learning curve possible	
		Designer	MED	2	3	3			
Engineering Analysis	HIGH	MEP Engineer	HIGH	2	2	2			MAYBE
		Architect	MED	2	2	2			
Design Reviews	MED	Arch	LOW	1	2	1		Revie[illegible] model	NO
								no [illegible] required	
3D Coordination (Design)	HIGH	Architect	HIGH	2	2	2	Coordination software required	Con[illegible] to [illegible] Coo[illegible]	YES
		MEP Engineer	MED	2	2	1			
		Structural Engine	HIGH	2	2	1			
Design Authoring	HIGH	Architect	HIGH	3	3	3			YES
		MEP Engineer	MED	3	3	3			
		Structural Engine	HIGH	3	3	3			
		Civil Engineer	LOW	2	1	1	Large learning curve	Civil not required	
Programming	MED							Planning Phase Complete	NO

* Additional BIM Uses as well as information on each Use can be found at http://www.engr.psu.edu/ae/cic/bimex/

Phase Planning

Description:

A process in which a 4D model (3D models with the added dimension of time) is utilized to effectively plan the phased occupancy in a renovation, retrofit or addition, or to show the construction sequence and space requirements on a building site. 4D modeling is a powerful visualization and communication tool that can give a project team much better understanding of project milestones and construction plans.

Potential Value:

- Better understanding of the phasing schedule by the owner and project participants and showing the critical path of the project
- Dynamic phasing plans of occupancy offering multiple options and solutions to space conflicts
- Integrate planning of human, equipment and material resources with the BIM model to better schedule and cost estimate the project
- Space and workspace conflicts identified and resolved ahead of the construction process
- Marketing purposes and publicity
- Identification of schedule, sequencing or phasing issues
- More readily constructible, operable and maintainable project (Kang et al., 2007)
- Monitor procurement status of project materials (Kang et al., 2007)
- Increased productivity and decreased waste on job sites (Sheppard, 2004)
- Conveying the spatial complexities of the project, planning information, and support conducting additional analyses (Koo and Fischer, 2000)

Resources Required:

- 3D Model manipulation
- Scheduling software

Team Competencies Required:

- Knowledge of construction scheduling and general construction process. A 4D model is connected to a schedule, and is therefore only as good as the schedule to which its linked.
- Ability to manipulate, navigate, and review a 3D model.
- Knowledge of 4D software: import geometry, manage links to schedules, produce and control animations, etc.

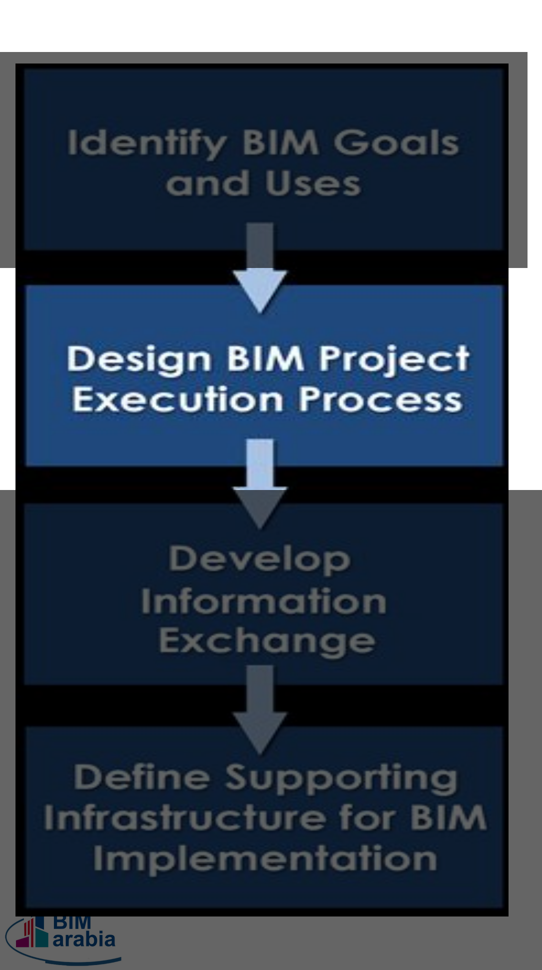
Selected Resources:

- Dawood, N., and Mallasi, Z. (2006). Construction Workplace Planning: Assignment and Analysis Utilizing 4D Visualization Technologies. *Computer-aided Civil and Infrastructure Engineering*, Pgs. 498-513.
- Jongeling, R., Kim, J., Fischer, M., Morgeous, C., and Olofsson, T. (2008). Quantitative analysis of workflow, temporary structure usage, and productivity using 4D models. *Automation in Construction*, Pgs. 780-791.
- Kang, J. H., Anderson, S. D., and Clayton, M. J. (2007). Empirical Study on the Merit of Web-based 4D Visualization in Collaborative Construction Planning and Scheduling. *Journal of Construction Engineering and Management*, Pgs. 447-461.

"Begin with the end in mind."

BIM Uses	Asset Management	Design Management	Resources (Time/cost)	Sustainability / Environment	Communication / Information Production
3D design coordination	✓	✓	✓	✓	✓
Asset management	✓			✓	✓
Assurance and data validation	✓	✓	✓	✓	✓
Bespoke BIM object library authoring	✓	✓			✓
Building systems analysis		✓	✓	✓	
Cost estimation and management	✓	✓	✓	✓	✓
Data classification	✓	✓	✓	✓	✓
Design (BIM) authoring	✓	✓	✓	✓	✓
Digital fabrication		✓	✓	✓	
Disaster planning	✓				✓
Drawing generation	✓	✓	✓	✓	✓
Energy analysis		✓	✓	✓	
Existing and record modelling		✓		✓	✓
Field management tracking	✓	✓	✓		✓
Lighting analysis		✓	✓	✓	
Pedestrian simulation for hazard and dwell time	✓	✓			✓
Planned maintenance	✓		✓		
Planning, sequencing and simulation		✓	✓		✓
Possessions and permit to work		✓	✓		✓
Reviews	✓	✓	✓	✓	✓
Site analysis		✓	✓	✓	
Spatial optimisation, management and tracking	✓	✓			✓
Structural analysis		✓	✓	✓	
Sustainability evaluation	✓	✓	✓	✓	
Visualisation and communication	✓	✓			✓

BIM arabia



Level 1: BIM Execution Planning Process

Project Title

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.

BIM USES

INFO. EXCHANGE

Design Development

Create 4D Model

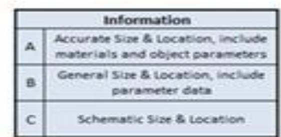
Contractor	4D Modeling

Identify BIM Goals and Uses

Design BIM Project Execution Process

Develop Information Exchange

Define Supporting Infrastructure for BIM Implementation



Information	
A	Accurate Size & Location, include materials and object parameters
B	General Size & Location, include parameter data
C	Schematic Size & Location

Responsible Party	
A	Architect
C	Contractor
CV	Civil Engineer
FM	Facility Manager
MEP	MEP Engineer
SE	Structural Engineer
TC	Trade Contractors

Information Exchange Title			Design Authoring			3D Coordination			Energy Analysis		
			OUTPUT			INPUT			INPUT		
Time of Exchange (SD, DD, CD, Construction)						DD			DD		
Model Reciever			N/A			C, TC			MEP		
Reciever File Format											
Application & Version											
Model Element Breakdown			Info	Resp Party	Notes	Info	Resp Party	Notes	Info	Resp Party	Notes
B	SHELL										
	Superstructure										
		Floor Construction	B	A		B	A		B	A	
		Roof Construction	B	A		B	A		B	A	
	Exterior Enclosure										
		Exterior Walls	B	A		A	A		B	A	R Value
		Exterior Windows	B	A		B	A		A	A	Rvalue
		Exterior Doors	B	A					C	A	
	Roofing										
		Roof Coverings	B	A							
		Roof Openings	B	A		A	A		B	A	
C	INTERIORS										
	Interior Construction										
		Partitions	B	A		B	A		B	A	
		Interior Doors							C	A	
		Fittings	B	A		B	A			A	
	Stairs										
		Stair Construction	B	A		B	A		B	A	
		Stair Finishes									
	Interior Finishes										
		Wall Finishes							B	A	Reflectance
		Floor Finishes							B	A	Reflectance
		Ceiling Finishes							B	A	Reflectance
D	SERVICES										



Identify BIM Goals and Uses

Design BIM Project Execution Process

Develop Information Exchange

Define Supporting Infrastructure for BIM Implementation

BIM PROJECT EXECUTION PLAN
VERSION 2.0
FOR
[PROJECT TITLE]
DEVELOPED BY
[AUTHOR COMPANY]

This template is a tool that is provided to assist in the development of a BIM project execution plan as required per contract. The template plan was created from the buildingSMART alliance™ (bSa) Project "BIM Project Execution Planning" as developed by The Computer Integrated Construction (CIC) Research Group of The Pennsylvania State University. The bSa project is sponsored by The Charles Pankow Foundation (http://www.pankowfoundation.org), Construction Industry Institute (CII) (http://www.construction-institute.org), Penn State Office of Physical Plant (OPP) (http://www.opp.psu.edu), and The Partnership for Achieving Construction Excellence (PACE) (http://www.engr.psu.edu/pace). The BIM Project Execution Planning Guide can be downloaded at http://www.engr.psu.edu/BIM/PxP.

This coversheet can be replaced by a company specific coversheet that includes at a minimum document title, project title, project location, author company, and project number.













SECTION D: PROJECT GOALS / BIM USES

Describe how the BIM Model and Facility Data are leveraged to maximize project value (e.g. design alternatives, life-cycle analysis, scheduling, estimating, material selection, pre-fabrication opportunities, site placement, etc.) Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet.

1. MAJOR BIM GOALS / OBJECTIVES:

State Major BIM Goals and Objectives

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES

2. BIM USE ANALYSIS WORKSHEET: ATTACHMENT 1

Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet. Attach BIM Use analysis Worksheet as Attachment 1.

3. BIM USES:

Highlight and place an X next to the additional BIM Uses as selected by the project team using the BIM Goal & Use Analysis Worksheet. See BIM Project Execution Planning Guide at www.engr.psu.edu/BIM/BIM_Uses for Use descriptions. Include additional BIM Uses as applicable in empty cells.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS		DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
			3D COORDINATION		3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
			MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

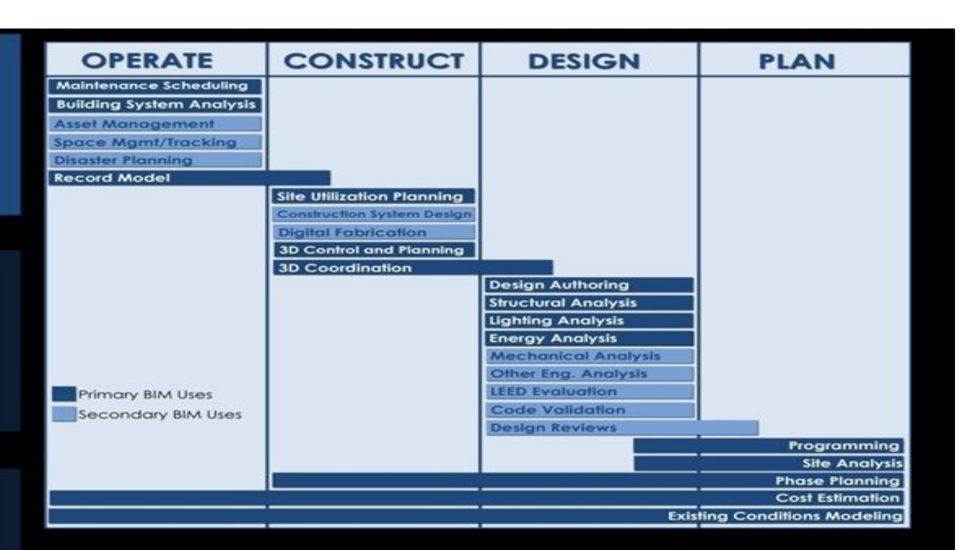




Design BIM Project Execution Process

Develop Information Exchange

Define Supporting Infrastructure for BIM Implementation



"Begin with the end in mind."

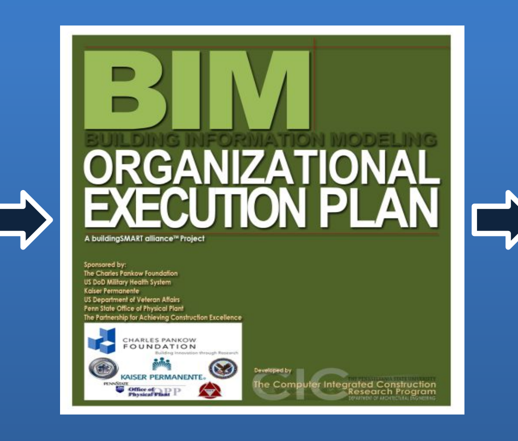


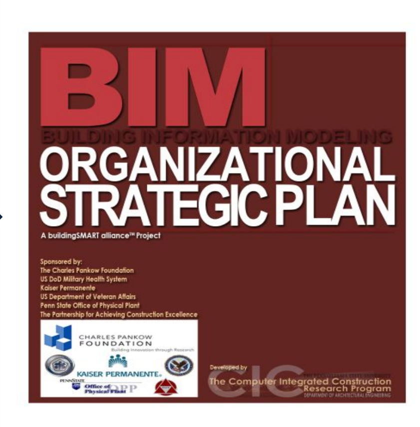
Recommended Organizational BIM Integration Progression

BIM Planning Guide for Facility Owners











BIM Roadmap to Standardization & Facilities Management(Long-term Goals)

2010 *Logistics Capabilities* 2011 *Initial Operating Capabilities* 2012 *Initial Standardization* 2015 *Full Operational Capabilities* 2030

	2010 – 2011: *Logistics Capabilities*	2011 – 2012: *Initial Operating Capabilities*	2012 – 2015: *Initial Standardization*	2015 – 2030: *Full Operational Capabilities*
Project Specific	Acquire Minimum required facilities for BIM execution Establish a Quality Assurance Program	Develop BIM model and Facility Data for MSC	Validate models using the revised QAP	
OPP Specific	Develop Contracting language, templates and execution standards Train __% OPP personnel in BIM tool utilization and management (BIM 101 & BIM 201)	Train staff in the QAP process BIM Design Services Integration	Design Standards Implementation	OPP BIM Services/ Requirements Standardization
University Specific		Develop BIM standards for other campuses Model __% of campus buildings	Model __% of campus buildings	Model __% of campus buildings



BIM Planning Procedures

ORGANIZATIONAL STRATEGY

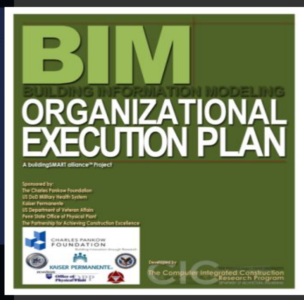
ASSESS ALIGN DEVELOP ADVANCE

assists in planning an organization's BIM Strategy through assessing the organization's BIM Maturity, aligning BIM Vision and Objectives to organization's Mission and Goals, and developing an advancement plan to integrate BIM with an organization.

ORGANIZATIONAL EXECUTION

ESTABLISH IDENTIFY DESIGN DETERMINE

assists in planning detailed BIM implementation within the operations of an organization through establishing organizational goals and BIM objectives; identifying BIM Uses; designing processes; and determining information, infrastructure, and personnel needs



PROJECT PROCUREMENT



CREATE GENERATE DRAFT EXECUTE

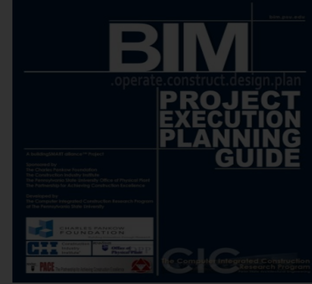
assists in identifying considerations for the procuring BIM Services on projects, including Request for Proposals, Requests for Qualifications, Contract Language, and Template BIM Plans

PROJECT EXECUTION



IDENTIFY DESIGN DETERMINE DESIGN

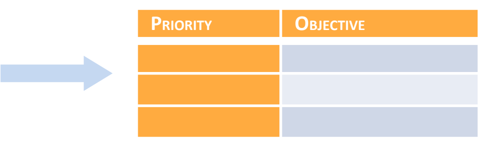
assists a project team to maximize the benefit of BIM implementation for a facility construction project through identifying project goals and BIM Uses, designing the BIM execution process, developing information exchanges, and defining infrastructure



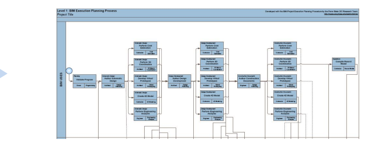


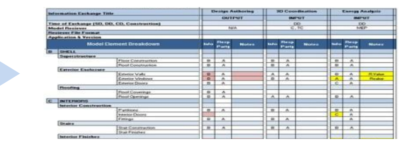
Organizational BIM Execution Planning Procedure

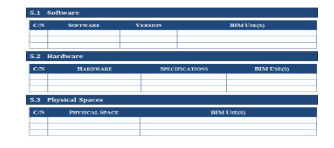
Vision and Objectives	Determine the BIM Vision and Objectives for the duration of the Execution Plan
Uses	Determine how the organization will use BIM during the operations phase
Process	Map the Organizational Processes including future BIM Processes
Information	Determine and Document operational information needs including attributes
Infrastructure	Determine operational infrastructure including hardware, software, and spaces
Personnel	Determine Personnel Needs to support the implementation of BIM

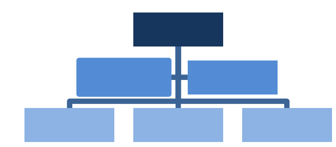


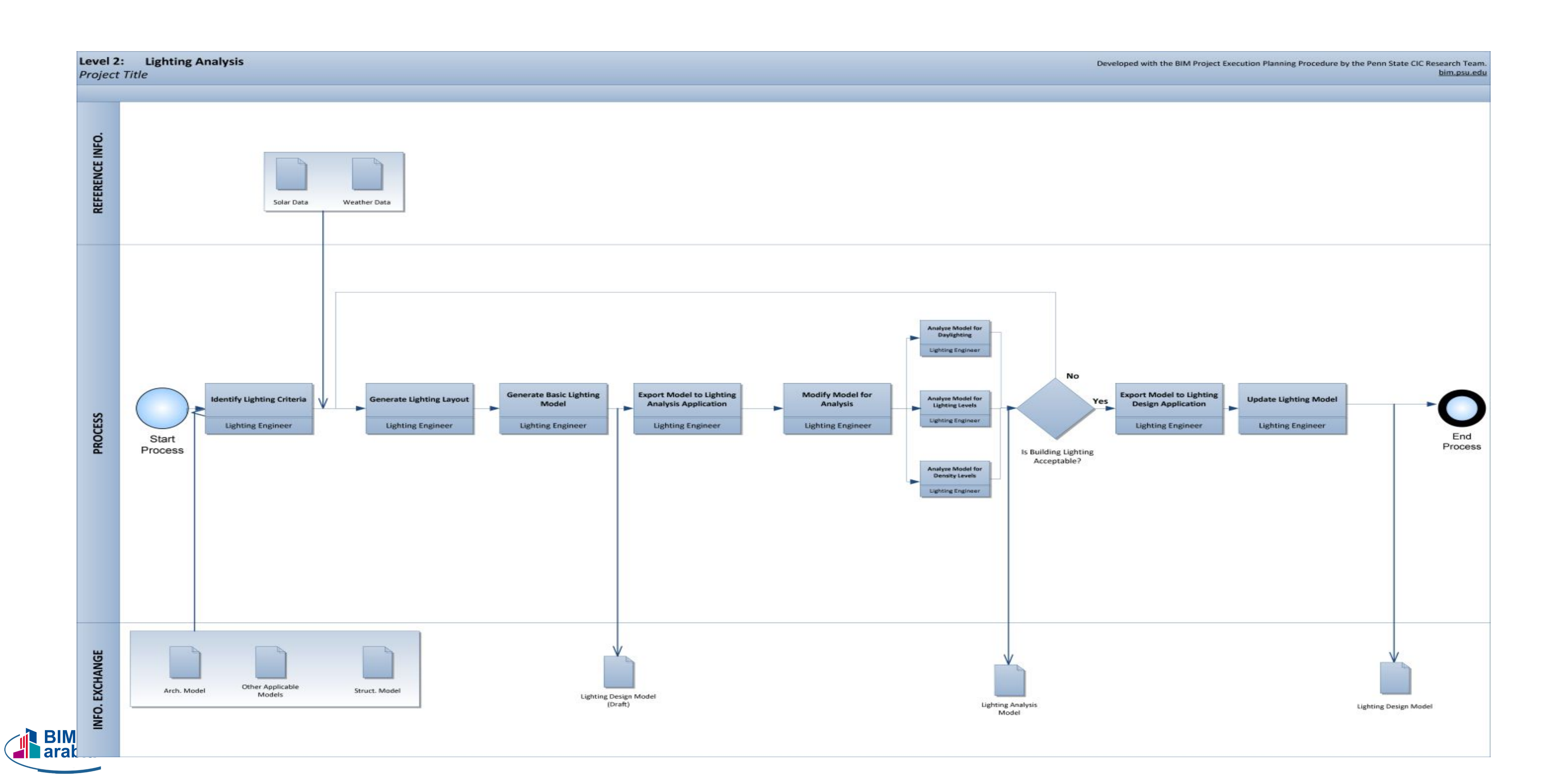








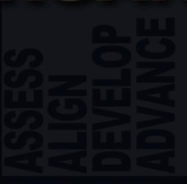




Level 2: Lighting Analysis
Project Title
Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.
bim.psu.edu
REFERENCE INFO.
Solar Data
Weather Data
PROCESS
Start Process
Identify Lighting Criteria
Lighting Engineer
Generate Lighting Layout
Lighting Engineer
Generate Basic Lighting Model
Lighting Engineer
Export Model to Lighting Analysis Application
Lighting Engineer
Modify Model for Analysis
Lighting Engineer
Analyze Model for Daylighting
Lighting Engineer
Analyze Model for Lighting Levels
Lighting Engineer
Analyze Model for Density Levels
Lighting Engineer
No
Yes
Is Building Lighting Acceptable?
Export Model to Lighting Design Application
Lighting Engineer
Update Lighting Model
Lighting Engineer
End Process
INFO. EXCHANGE
Arch. Model
Other Applicable Models
Struct. Model
Lighting Design Model (Draft)
Lighting Analysis Model
Lighting Design Model

Model Element Breakdown				LoD	Facility Data	Notes
01	SUBSTRUCTURE			100		
01	10	Foundations		LoD		
01	10	10	Standard Foundations	LoD		
01	10	20	Special Foundations	LoD		
01	20	Subgrade Enclosures		LoD		
01	20	10	Walls for Subgrade Enclosures	LoD		
01	40	Slabs-On-Grade		LoD		
01	40	10	Standard Slabs-On-Grade	LoD		
01	40	20	Structural Slabs-On-Grade	LoD		
01	40	30	Slab Trenches	LoD		
01	40	40	Pits and Bases	LoD		
01	40	50	Slab-On-Grade Supplementary Components	LoD		
01	60	Water and Gas Mitigation		LoD		
01	60	10	Building Subdrainage	LoD		
01	60	20	Off-Gassing Mitigation	LoD		
01	90	Substructure Related Activities		LoD		
01	90	10	Substructure Excavation	LoD		
01	90	20	Construction Dewatering	LoD		
01	90	30	Excavation Support	LoD		
01	90	40	Soil Treatment	LoD		
02	SHELL			LoD		
02	10	Superstructure		LoD		
02	10	10	Floor Construction	LoD		
02	10	20	Roof Construction	LoD		
02	10	30	Stairs	LoD		
02	20	Exterior Vertical Enclosures		LoD		
02	20	10	Exterior Walls	LoD		

ORGANIZATIONAL STRATEGY

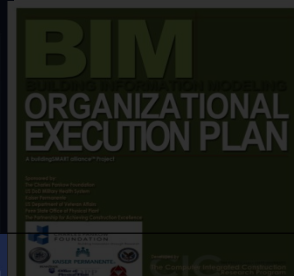


assists in planning an organization's BIM Strategy through assessing the organization's BIM Maturity, aligning BIM Vision and Objectives to organization's Mission and Goals, and developing an advancement plan to integrate BIM with an organization.

ORGANIZATIONAL EXECUTION



assists in planning detailed BIM implementation within the operations of an organization through establishing organizational goals and BIM objectives; identifying BIM Uses; designing processes; and determining information, infrastructure, and personnel needs



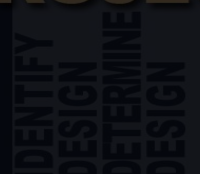
PROJECT PROCUREMENT

BIM
BUILDING INFORMATION MODELING
PROJECT PROCUREMENT PLAN
A buildingSMART alliance™ Project



assists in identifying considerations for the procuring BIM Services on projects, including Request for Proposals, Requests for Qualifications, Contract Language, and Template BIM Plans

PROJECT EXECUTION



assists a project team to maximize the benefit of BIM implementation for a facility construction project through identifying project goals and BIM Uses, designing the BIM execution process, developing information exchanges, and defining infrastructure





Contract Requirements

- Document Hierarchy
- Use of BIM Project Execution Plan
- Data / Model Ownership
- Minimum Requirements
- 2D Requirements
- Security
- Insurance

Standard BIM Execution Plan Template

- Goals
- Uses
- Process
- Model Details
- Data Details
- Meeting Schedule

Common to both

- Definitions
- Team Responsibilities
- Collaboration
- Deliverables
- Quality Control/ Assurance Plan



ORGANIZATIONAL STRATEGY

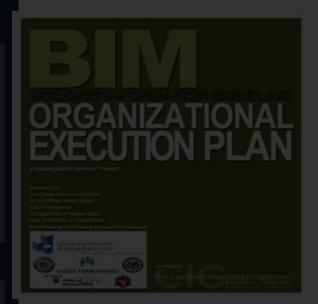
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ORGANIZATIONAL EXECUTION

ESTABLISH IDENTIFY DESIGN DETERMINE

assists in planning detailed BIM implementation within the operations of an organization through establishing organizational goals and BIM objectives; identifying BIM Uses; designing processes; and determining information, infrastructure, and personnel needs



PROJECT PROCUREMENT

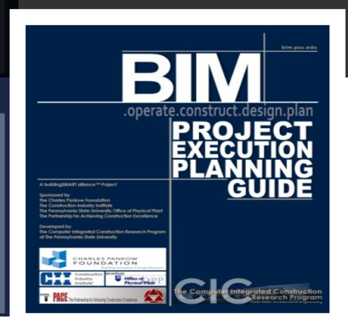


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PROJECT EXECUTION

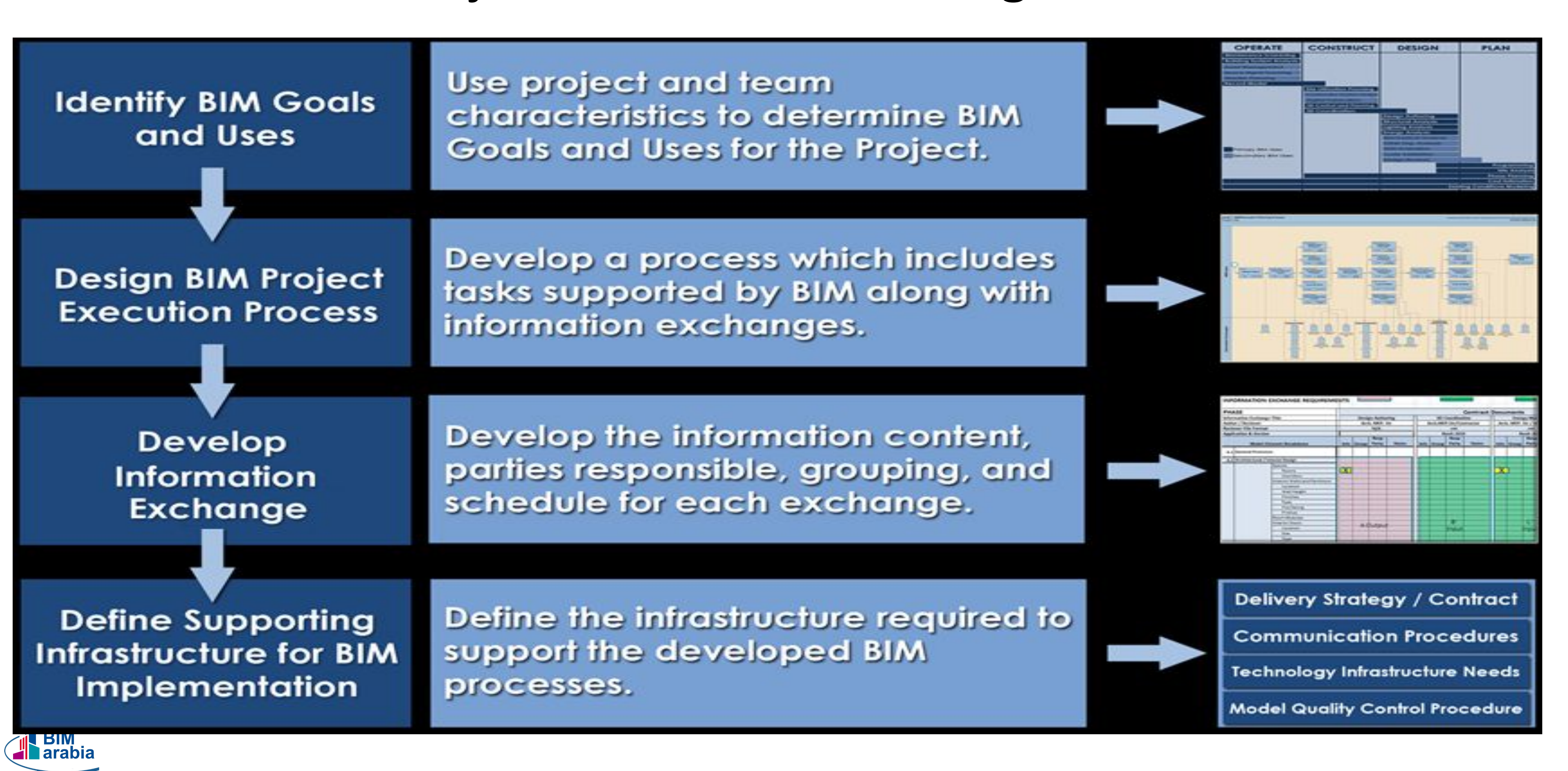


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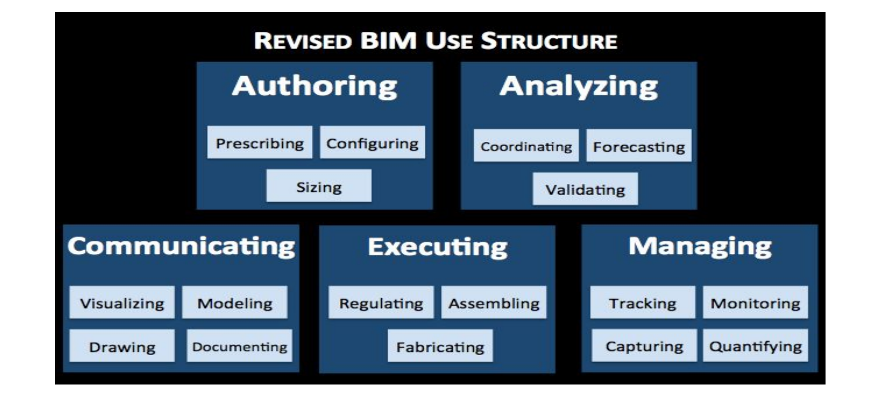


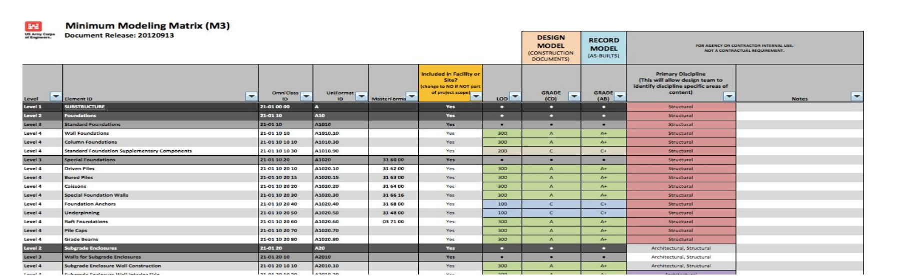


BIM Project Execution Planning Procedure



BIM Use Structure



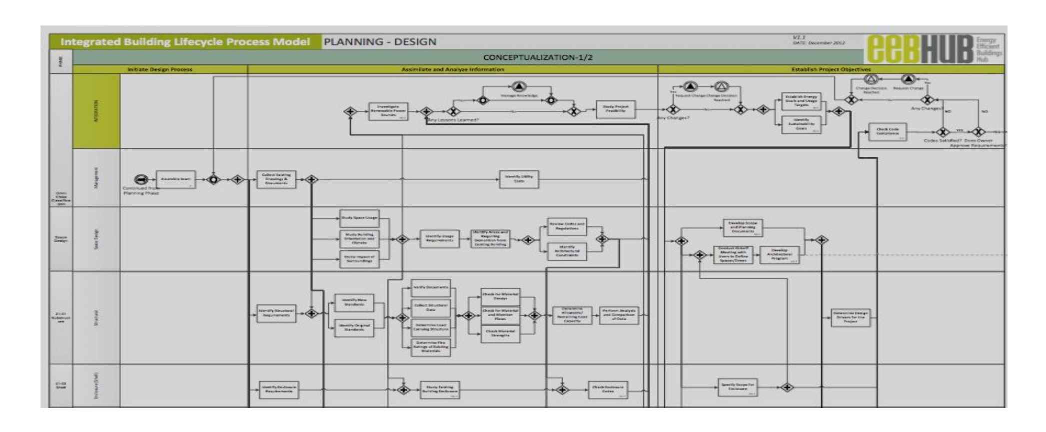


Minimum Modeling Matrix (M3)
Document Release: 20120913

						DESIGN MODEL (CONSTRUCTION DOCUMENTS)	RECORD MODEL (AS-BUILTS)	FOR AGENCY OR CONTRACTOR INTERNAL USE. NOT A CONTRACTUAL REQUIREMENT.	
Level	Element ID	OmniClass ID	UniFormat ID	MasterForma	Included in Facility or Site? (change to NO if NOT part of project scope)	LOD	GRADE (CD)	GRADE (AB)	Primary Discipline (This will allow design team to identify discipline specific areas of content)	Notes
Level 1	SUBSTRUCTURE	21-01 00 00	A		Yes	•	•	•	Structural	
Level 2	Foundations	21-01 10	A10		Yes	•	•	•	Structural	
Level 3	Standard Foundations	21-01 10	A1010		Yes	•	•	•	Structural	
Level 4	Wall Foundations	21-01 10 10	A1010.10		Yes	300	A	A+	Structural	
Level 4	Column Foundations	21-01 10 10 10	A1010.30		Yes	300	A	A+	Structural	
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.90		Yes	200	C	C+	Structural	
Level 3	Special Foundations	21-01 10 20	A1020	31 60 00	Yes	•	•	•	Structural	
Level 4	Driven Piles	21-01 10 20 10	A1020.10	31 62 00	Yes	300	A	A+	Structural	
Level 4	Bored Piles	21-01 10 20 15	A1020.15	31 63 00	Yes	300	A	A+	Structural	
Level 4	Caissons	21-01 10 20 20	A1020.20	31 64 00	Yes	300	A	A+	Structural	
Level 4	Special Foundation Walls	21-01 10 20 30	A1020.30	31 66 16	Yes	300	A	A+	Structural	
Level 4	Foundation Anchors	21-01 10 20 40	A1020.40	31 68 00	Yes	100	C	C+	Structural	
Level 4	Underpinning	21-01 10 20 50	A1020.50	31 48 00	Yes	100	C	C+	Structural	
Level 4	Raft Foundations	21-01 10 20 60	A1020.60	03 71 00	Yes	300	A	A+	Structural	
Level 4	Pile Caps	21-01 10 20 70	A1020.70		Yes	300	A	A+	Structural	
Level 4	Grade Beams	21-01 10 20 80	A1020.80		Yes	300	A	A+	Structural	
Level 2	Subgrade Enclosures	21-01 20	A20		Yes	•	•	•	Architectural, Structural	
Level 3	Walls for Subgrade Enclosures	21-01 20 10	A2010		Yes	•	•	•	Architectural, Structural	
Level 4	Subgrade Enclosure Wall Construction	21-01 20 10 10	A2010.10		Yes	300	A	A+	Architectural, Structural	

Information Exchanges

Process



Lessons Learned from Case Studies

- Need BIM Champion(s)
- Owner Involvement is Critical
- Need team Buy-in and Transparency
- The Planning Procedure should allow for Adaptations by the Project Team
- The Project Execution Plan must be considered a Living Document
- Planning takes Resources and it is Critical that Resources are Available



DON’T OVERCOMPLICATE THE BIM EXECUTION PLAN.

I’ve found that the best way to keep BIM execution plans simple is by following these steps:

• Outline the expectations of Building Team. Have a discussion early on about which team members will be modeling which pieces of the building. For instance, the architect typically starts the structural layout, so the team needs to determine what is expected of the structural engineer and when it needs to be delivered. The architect may drive critical design elements, like slab edge locations, but I prefer that the structural engineer owns the slabs as early in the process as possible.





Family Naming - BS8541-1



BIM Level 2 requires families to be named according to BS8541-1.

Do this from the start.

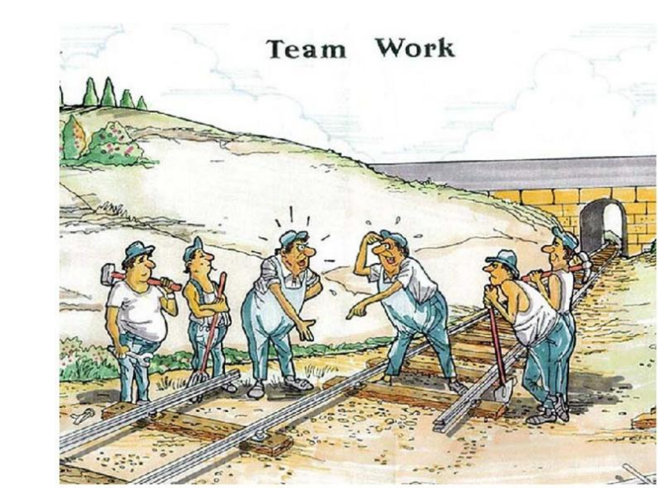
If you are a designer creating generic objects, family names will be in the format Source_Type_Subtype. Use Organisation Acronyms for the source. Types should be IFC names and be consistent i.e. Use Door and not doors. The IFC names are included in BS8541-1. Subtypes are flexible but should be structured to ensure there is a consistent system for naming. I use the T-Sheet code and an optional description e.g. ME_Door_IDR-Dbl-Eq for an internal equal size leaf double door created by me. Obviously replace the Source acronym for your company acronym.



BIM is collaborative

BIM won't work without collaboration. BIM exists because of technology and a desire to improve the construction process. It isn't easy as there is a tendency in the business to carry on as usual. There is a growing unease that long term targets cannot be met through business as usual and that process that have developed over the past 40 years are not fit for purpose.

Providing an adequate and cost effective supply of places for people to live and work sustainability in the near future is very challenging. Individually we can go fast but collectively we can go far.

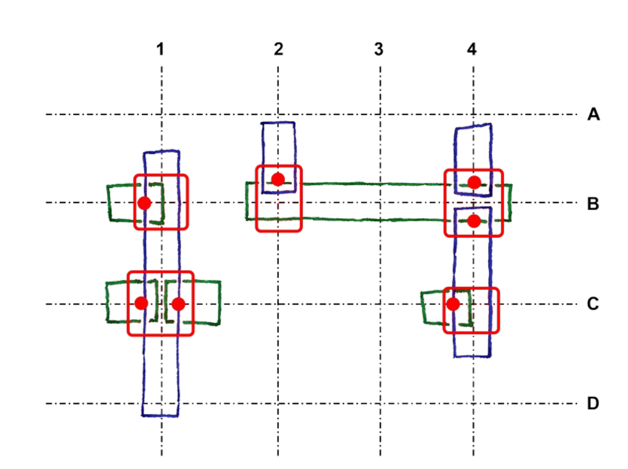




Shared Coordinates

If your linked models don't sit on top of each other accurately, you have a big problem and it is time to stop and sort this out. Each model should have a common survey point and base point. The Information Manager or Project Lead should ensure this is in place. The best way to standardize this is issue a master survey 2D CAD drawing which uses the correct coordinate system i.e. Ordnance Survey UK coordinates using True North.

Each organisation can then acquire the coordinates from this linked drawing. The recommended base and survey points should be indicated on the drawing. If the survey is in BIM format, the coordinates can be acquired from the linked survey model.



BIM arabia

Clash Detection

Start the process early. The first time it is done it takes some time to set up. Allow 2-3 days. Objects must be grouped into sets and clash tests setup to specifically target certain clash tests e.g. structural slab versus facade. Don't run a clash detection on everything i.e. structural model versus architectural model, the number of clashes will be overwhelming and difficult to manage. Organize objects into sets.



Unique Object IDs

If you are using clash detection tools such as Navisworks, Solebri or Tekla, these applications rely on unique IDs for each object to allow them to track objects. For clash detection it is important to understand if a clash is new, old (active) or resolved. This is the foundation of the process of resolving or progressively tracking clashes.



Maintain the same System Specs throughout the Team

It is important to have the same configuration for all your local systems in a network, from the OS, to the hardware and Revit updates. This is true even if you are collaborating over multiple Revit Servers. Very often you'll find sync operations taking forever. This occurs especially when there are multiple users accessing the central file at the same time. Add to this a bunch of differently configured workstations and you will end up lingering around the coffee machine for a long time.

We would often experience a weird issue of Permission requests moving around in circles from user to user, eventually causing the file to corrupt. I haven't identified what exactly leads to this problem.





Plan Your Revit Links Carefully

It is common practice to distribute model elements over multiple link files. But approach your Revit links with some solid strategy. Our project was three storeys high, with the built mass distributed over roughly 0.7sq km.

- A decision was made to vertically slice the building at two locations (the floor expansion joints), and store the three parts in separate link files.

MODEL LINKS GUIDE The model name consists of seven parts: (Project no | Originator | Zone no (XX for overall) | levels (XX for all levels

S.N				DEP.	SIZE /MB
01	PODIUM	321-EHAF-Z0-XX-M3-AR-PODIUM_CF	ARCH. ZONE 00 - PODIUM FROM LV B3 TO LV PDR ARCHITECTURE ELEMENTS AND ROOMS	ARCH.	36.00
02		321-EHAF-Z0-XX-M3-AR-PODIUM_CW_CF	ARCH. ZONE 00 - PODIUM CURTAIN WALL AND EXTERNAL CLADDING	ARCH.	11.40
03	TOWER 01	321-EHAF-Z1-XX-M3-AR-TOWER1_CF	ARCH. ZONE 01 - TOWER 1 ARCHITECTURE ELEMENTS AND ROOMS	ARCH.	22.10
04		321-EHAF-Z1-XX-M3-AR-TOWER1_CW_CF	ARCH. ZONE 01 - TOWER 1 CURTAIN WALL	ARCH.	15.00
05	TOWER 02	321-EHAF-Z2-XX-M3-AR-TOWER2_CF	ARCH. ZONE 02 - TOWER 2 ARCHITECTURE ELEMENTS AND ROOMS	ARCH.	21.00
06		321-EHAF-Z2-XX-M3-AR-TOWER2_CW_CF	ARCH. ZONE 02 - TOWER 2 CURTAIN WALL	ARCH.	15.00
07	COMMON	321-EHAF-Z2-XX-M3-AR-SKIN	MAIN PROJECT EXTERNAL CURTAIN FOR TOWER 02 AND PODIUM TOP	ARCH.	00.00
08		321-EHAF-Z2-XX-M3-AR-STAIRS_CF	OVERALL PROJECT STAIRS	ARCH.	01.70
09		321-EHAF-Z0-XX-M3-AR-URS	ARCH. UNIVERSAL REFFERENCE SYSTEM FOR LEVELS , GRIDS AND COORDINATES FOR ZONE 0	ARCH.	01.70
10		321-EHAF-Z1_Z2-XX-M3-AR-URS	ARCH. UNIVERSAL REFFERENCE SYSTEM FOR LEVELS , GRIDS AND COORDINATES FOR ZONE 1,2	ARCH.	01.70
11		321-EHAF-XX-XX-M2-AR-DOC_CF	ARCH. DOCUMENTATION'S MODEL FOR SHEETS ,ANNOTATING AND SCHEDULES	ARCH.	06.70
12		321-EHAF-XX-XX-M3-AR-WCN	WORK IN PROGRESS CONTAINER (NOT FOR WORK-SHARING, ONLY FOR COMBINING THE WORK IN PROGRESS LINKS FOR REVIEW BEFORE DETACH FOR OTHER DECEPLINES)	ARCH.	11.80
13		321-EHAF-XX-XX-M3-AR-SCN	SHARED CONTAINER (NOT OPEN FOR WORK-SHARING, ONLY FOR COMBINING THE LINKS THAT ARE VERIFIED AND SHARED.)	ARCH.	11.80



APPLY THE TWO-INCH RULE.

This is one of the first rules of designing with BIM, yet I have seen many professionals get it wrong. It goes like this: Anything in a design that is smaller than two inches in size—such as wire, conduit, and pipe—should not be modeled, because small components can usually be worked around larger components on site.



build Standards. Period.

You will be surprised to know that our big project here, had no pre-defined Revit standards. This often lead to wasted time, confusion and inconsistencies. If you want things to run smooth like clockwork, you need standards. It allows you to automate boring little tasks, save you time and keep everyone on the same page.



Vaguely defined LOD creates Waste

This is a tricky one, but important nonetheless. Revit's 3D capabilities can often be seductive causing us to over-model. But this is only going to waste time. Our project was assigned LOD-300. But this lacks clarity because every element in the project will tend to be modelled differently. As in, the foundation could be LOD-100 and the doors and windows could be LOD-400. Hence, when preparing the execution plan, define LOD for each model element instead of assigning one for the entire project.

§ 4.3 Model Element Table

Identify (1) the LOD required for each Model Element at the end of each phase, and (2) the Model Element Author (MEA) responsible for developing the Model Element to the LOD identified.

Insert abbreviations for each MEA identified in the table below, such as "A – Architect," or "C – Contractor."

NOTE: LODs must be adapted for the unique characteristics of each Project.

Model Elements Utilizing CSI UniFormat™				LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	Note Number (See 4.4)
A SUBSTRUCTURE	A10 Foundations	A1010	Standard Foundations													
		A1020	Special Foundations													
		A1030	Slab on Grade													



BIM &LOD

LOD 100



Concept (Presentation

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:

DEPTH:

HEIGHT:

MANUFACTURER:
Herman Miller, Inc.
MODEL:
Mirra
LOD:
100

(Only data in **red** is useable)



Don’t Add new Members to Fight Fire

When there is a deadline at sight and a long list of tasks to be completed, instinct forces us to bring in new members to the team. Unfortunately,

this can only do more harm than good. New members have to understand the project and how the project is set up on Revit before they can attempt to do anything. You might waste more time guiding and teaching them, unable to attend to your own duties. If the situation requires additional members, it is better to assign them generic tasks

(sheet setup, annotation, printing etc.).



BIM meeting

- Always have field/management member involved with BIM meeting and the process
- Have at least one monthly review with 4D in BIM meetings to understand when critical areas are about to be installed.
- Even if it’s coordinated in the Federated Model, make sure it is installed per shop drawings obtained from the coordinated model.
- Train key management members to understand the BIM process
- Encourage subcontractors to use model review tools on site

- Weekly review the Federated Model with Superintendents
- Incorporate outstanding problems from BIM weekly meeting into subcontractor meetings to keep everyone on same page.





Automate

I remember trying to manually renumber over 1000 car parks. It was really frustrating when the layout would change or I missed a number. I did not know back then about Revit macros, plugins and Dynamo scripts (I was a noob). The team was so caught up on meeting the deadline that we forgot that we were working on Revit! But one teammate decided to do things differently. He set out to program a script on Dynamo to renumber the car parks quickly. After toiling away on it for a few hours, he saved us many hours in the long run.

Unfortunately, we tend to approach every software with a 'CAD mindset' when there are easier ways to get things done.

Encourage your team to find ways to expedite processes.

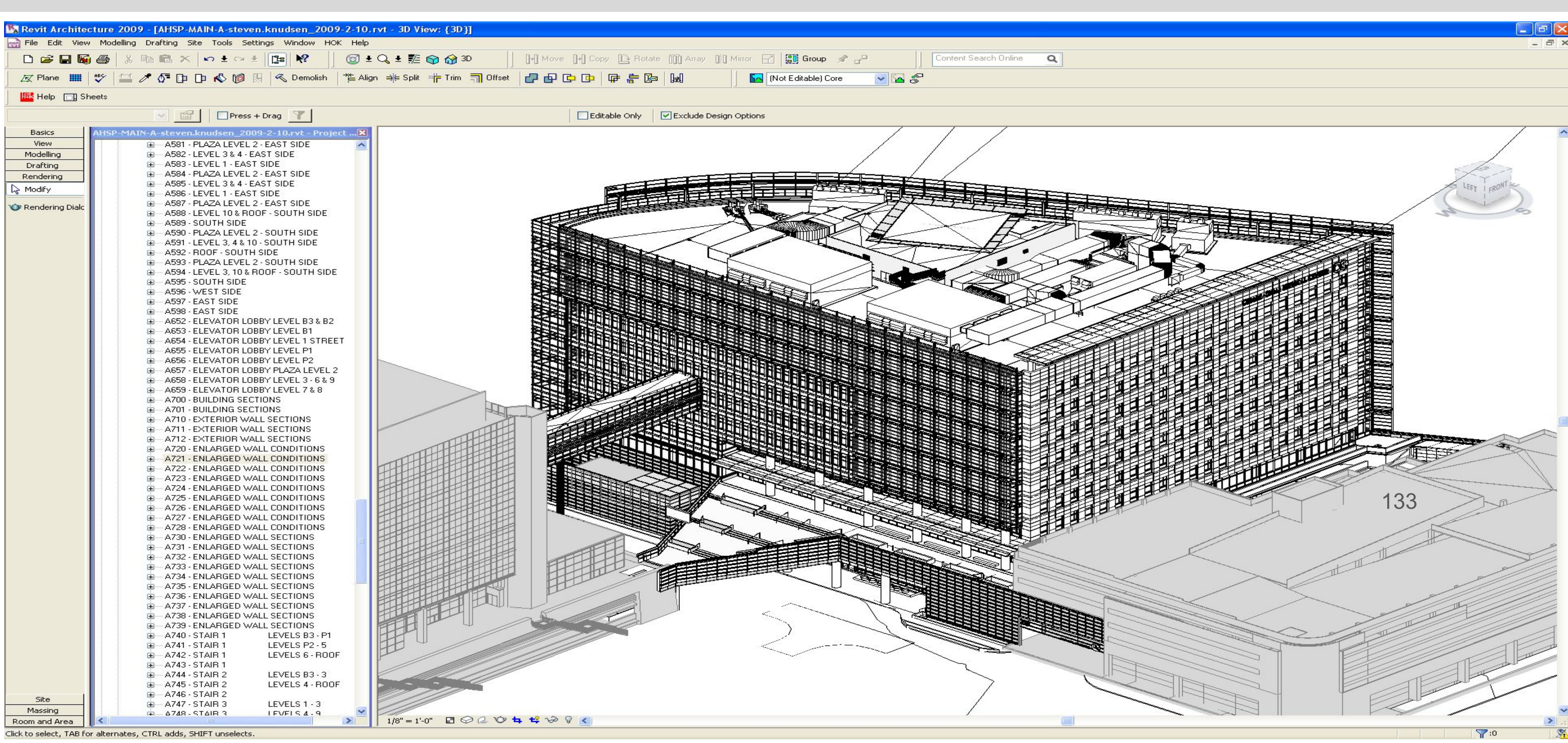


Actions

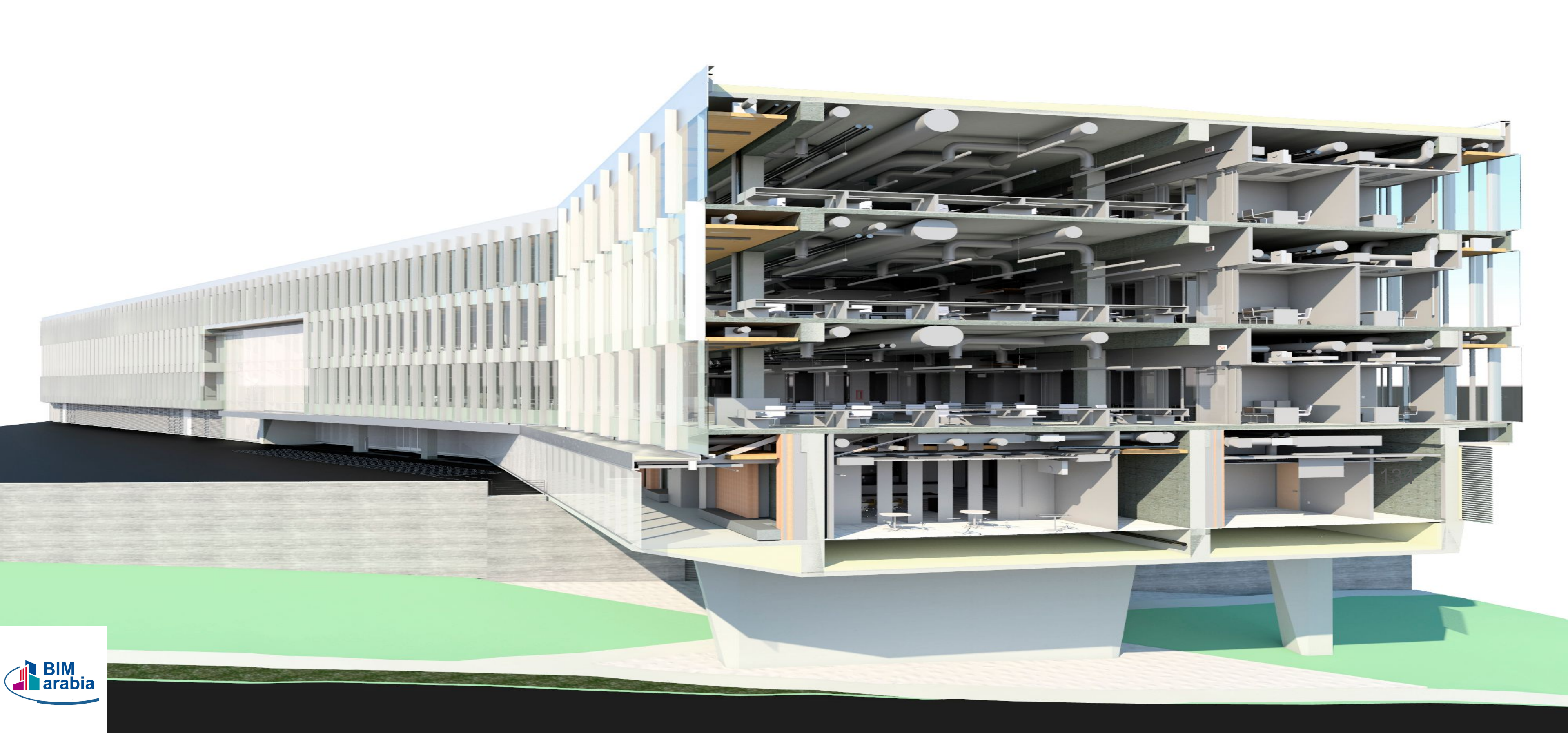
- Don’t just watch, start using it. (Shanghai Tower)
- Take a hands-on BIM course
- Train your staff
- 3D CE Software requires longer learning curve
- Big Data - the Biggest thing is Data
- If you want to implement BIM,
    - decide what data you need during O&M
    - design model = as-built model (permanent doc)
- If you are using BIM for your project,
    - hire a system analyst to review your workflow (IDM)
    - hire good database (and web) programmers
- During construction, BIM is active, Data is passive
- During maintenance, BIM is passive, Data is active



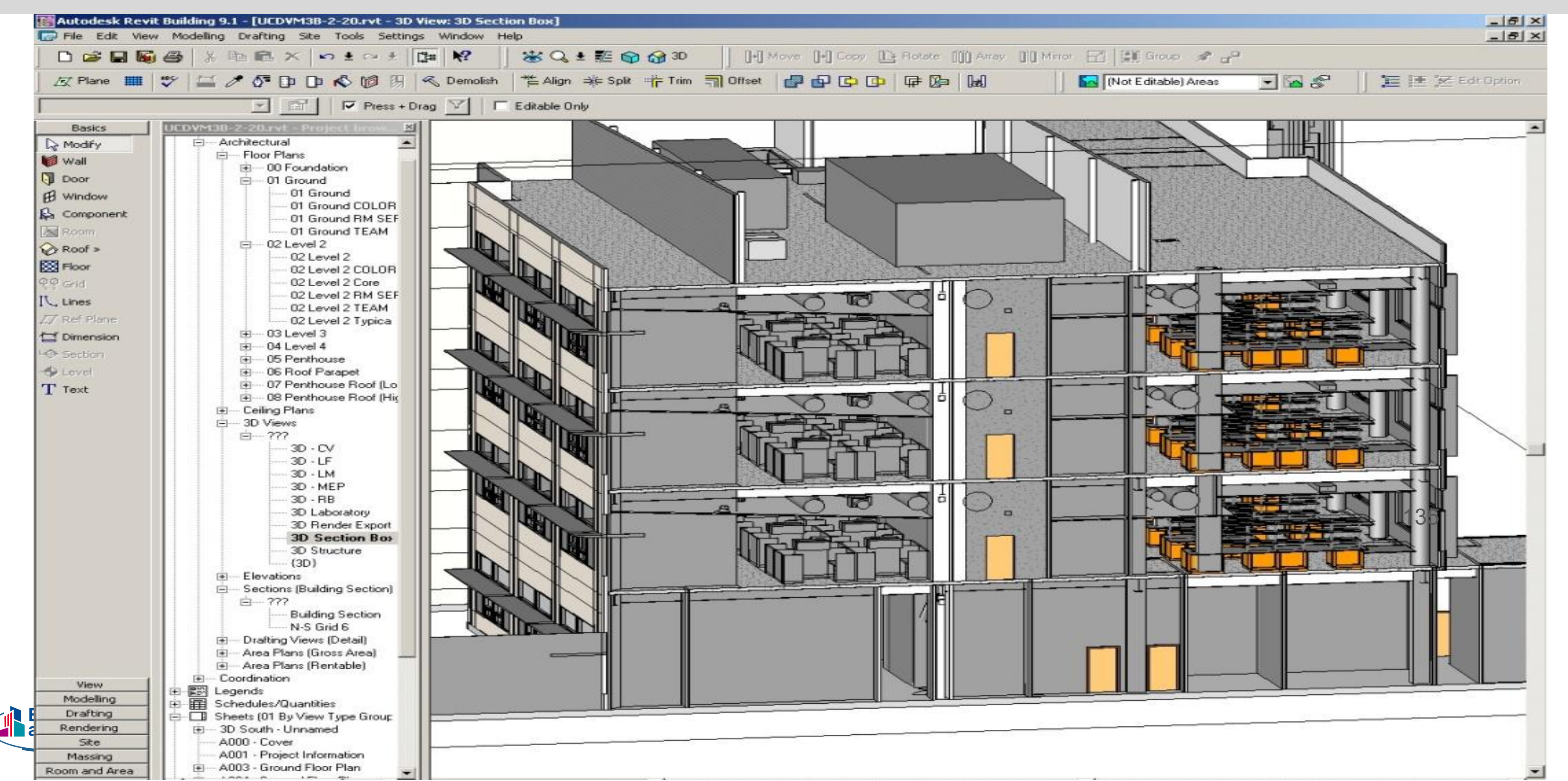
3D Detailed Models



3D Sections

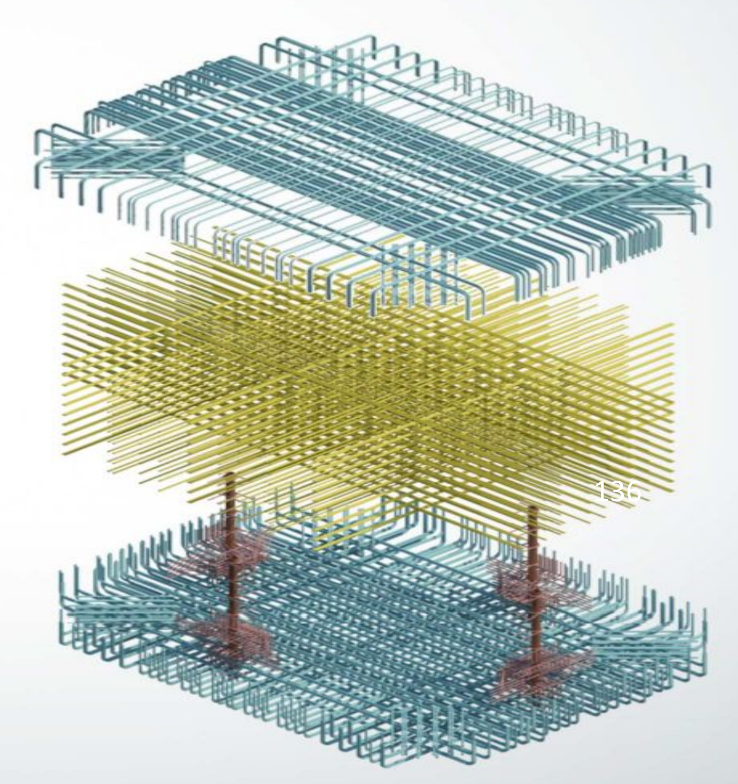


3D Sections



Autodesk Revit Building 9.1 - [UCDVM3B-2-20.rvt - 3D View: 3D Section Box]
File Edit View Modelling Drafting Site Tools Settings Window Help
Press + Drag
Editable Only
(Not Editable) Areas
Basics
Modify
Wall
Door
Window
Component
Room
Roof
Floor
Grid
Lines
Ref Plane
Dimension
Section
Level
Text
Architectural
Floor Plans
00 Foundation
01 Ground
01 Ground COLOR
01 Ground RM SEF
01 Ground TEAM
02 Level 2
02 Level 2 COLOR
02 Level 2 Core
02 Level 2 RM SEF
02 Level 2 TEAM
02 Level 2 Typica
03 Level 3
04 Level 4
05 Penthouse
06 Roof Parapet
Ceiling Plans
3D Views
3D - CV
3D - LF
3D - LM
3D - MEP
3D - RB
3D Laboratory
3D Render Export
3D Section Box
3D Structure
{3D}
Elevations
Sections (Building Section)
Building Section
N-S Grid 6
Drafting Views (Detail)
Area Plans (Gross Area)
Area Plans (Rentable)
Coordination
Legends
Schedules/Quantities
3D South - Unnamed
A000 - Cover
A001 - Project Information
A003 - Ground Floor Plan
View
Modelling
Drafting
Rendering
Site
Massing
Room and Area

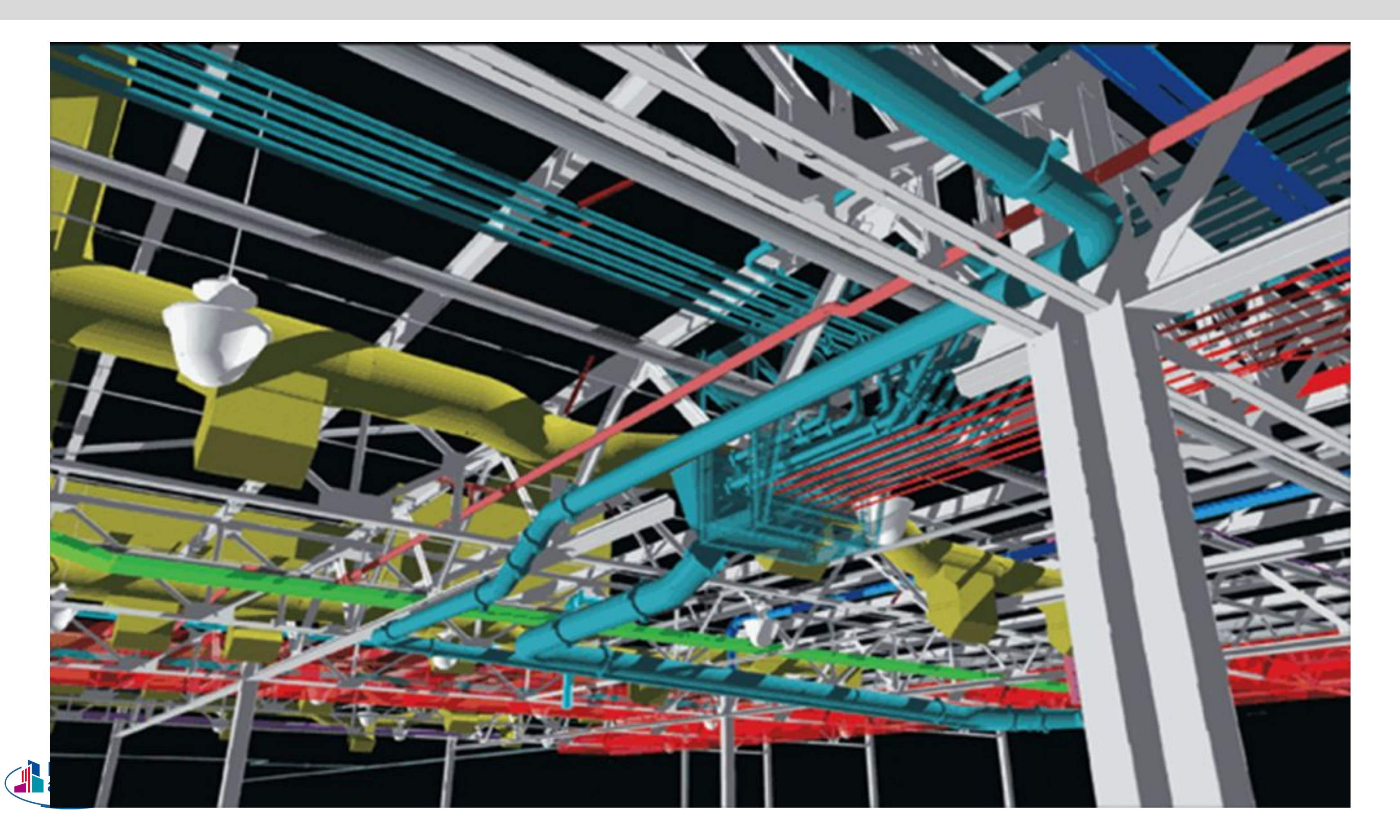
3D Detailed Models



3D MEP Detailed Model



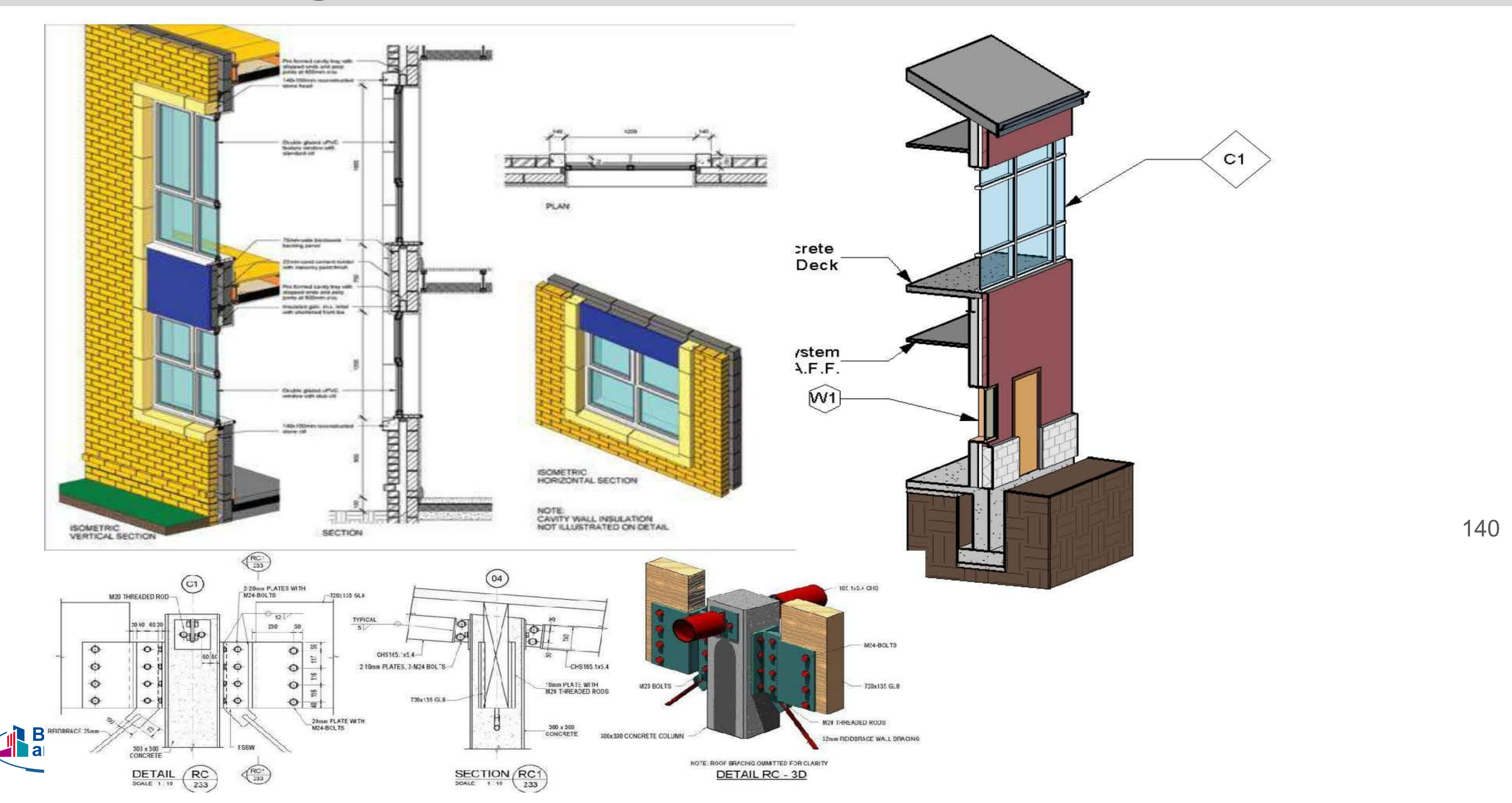
Coordination Review & Clashes Detection



Coordination Review & Clashes Detection



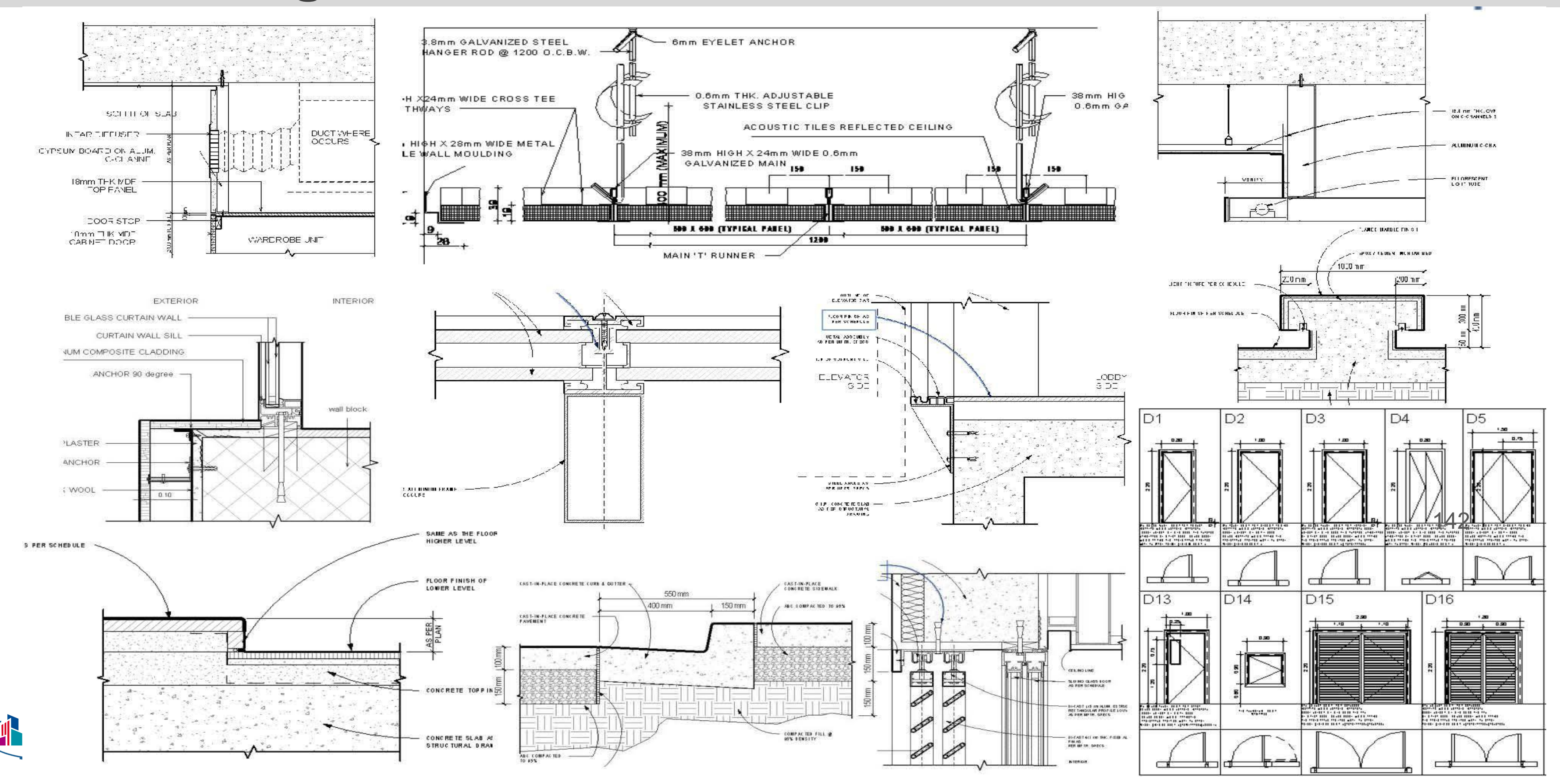
3D Detailing



Construction Drawings



2D Detailing



3D Visualization

3D Revit Render+PS



143

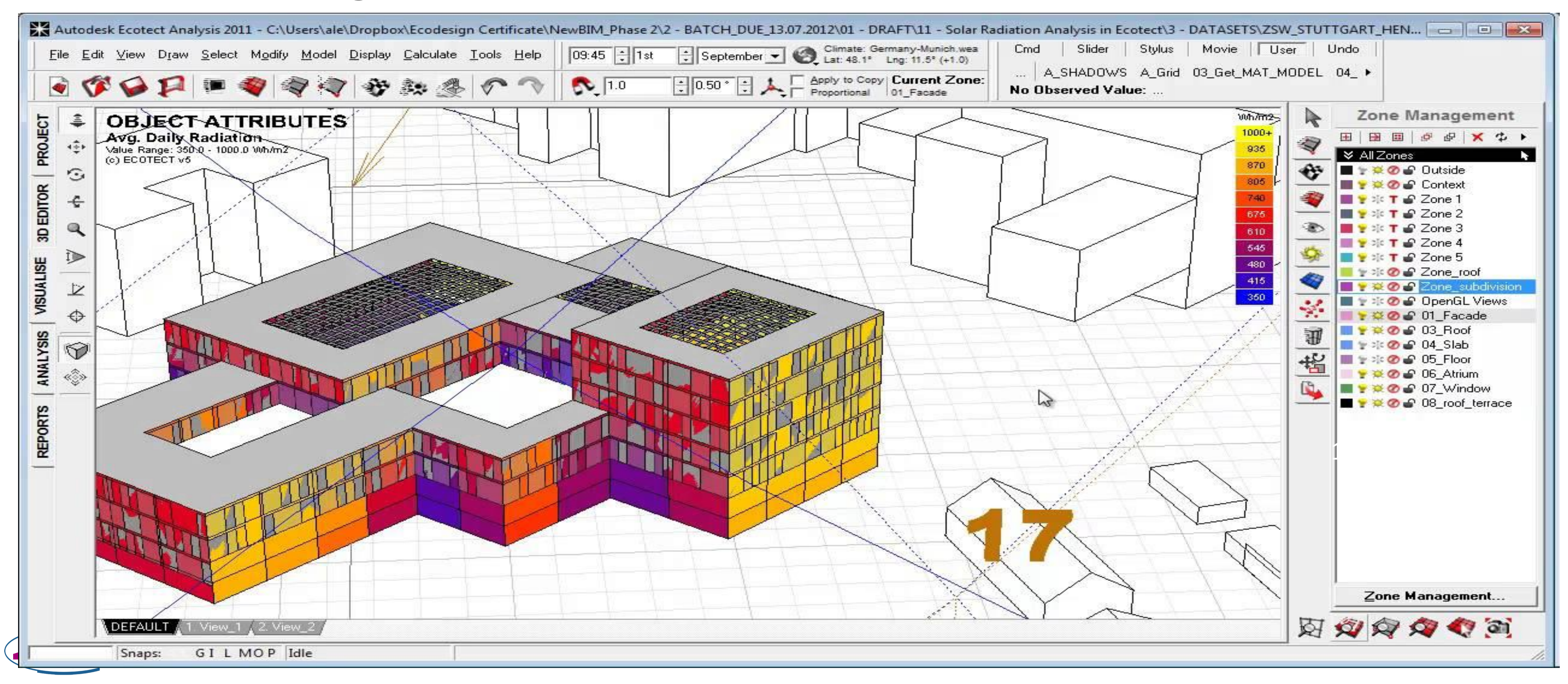
3D Visualization

3D Revit Render + Vray



Building Performance Analysis

Sustainable Design



4D

BIM, an acronym for 4D Building Information Modeling and a term widely used in the CAD industry, refers to the intelligent linking of individual 3D CAD components or assemblies with time- or schedule-related information.
The use of the term 4D is intended to refer to the fourth dimension: time, i.e. 4D is 3D plus schedule (time).
The construction of the 4D models enables the various participants (from architects, designers, contractors to owners) of a construction project, to visualize the entire duration of a series of events and display the progress of construction activities through the lifetime of the project. This BIM-centric approach towards project management technique has a very high potential to improve the project ma
delivery of construction project, of any size or complexity.

2D
Sheets
Plan
Section
Elevation

3D
Visualization
3D-Coordination
Clash Analysis

4D
Construction sequencing

Virtual Construction

(3D plus time element)

5D
Estimating

(3D plus cost element)

6D
Facility Management

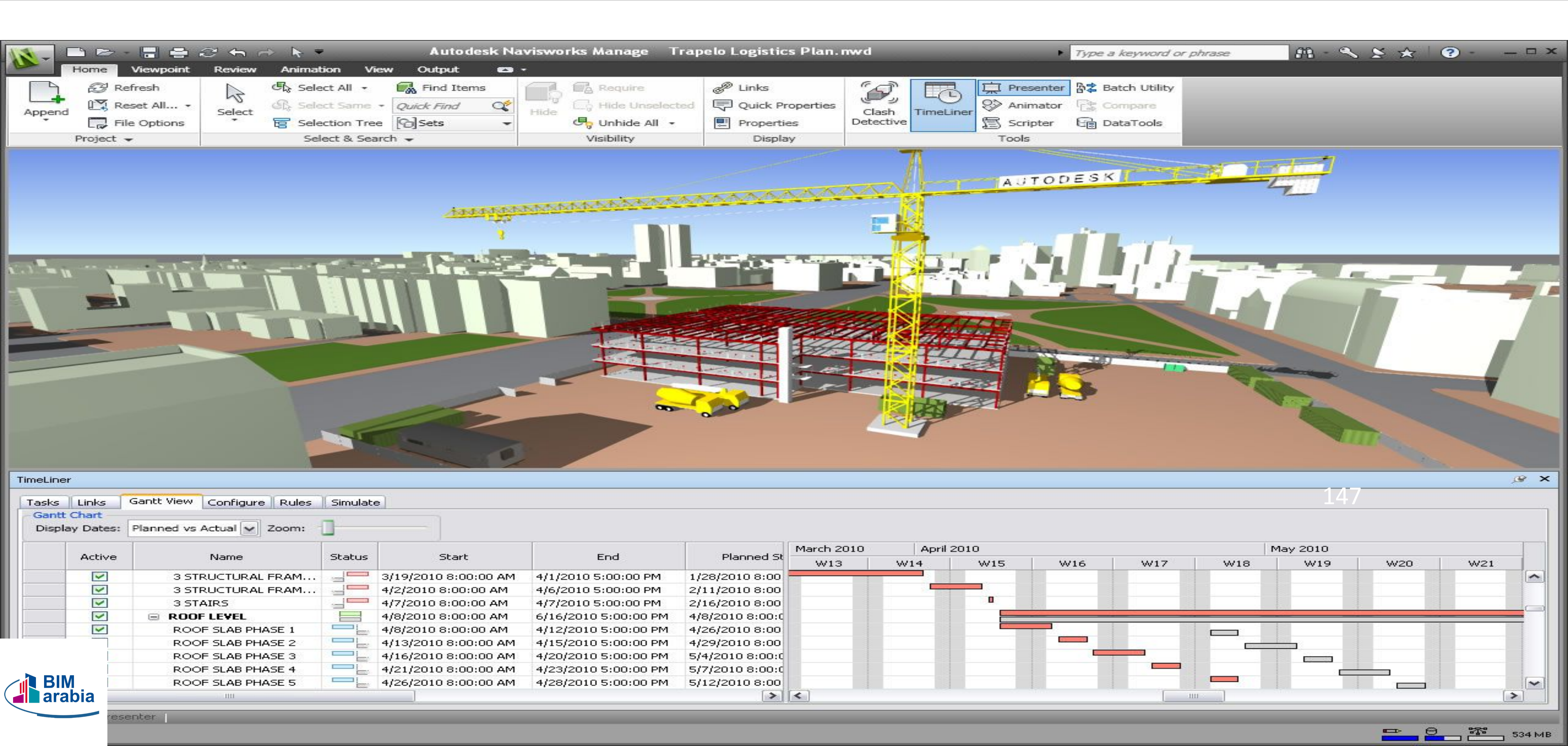
3D plus analysis element

Operation & Maintenance.

7D
RFID
Materials & Objects tracking



Time Line

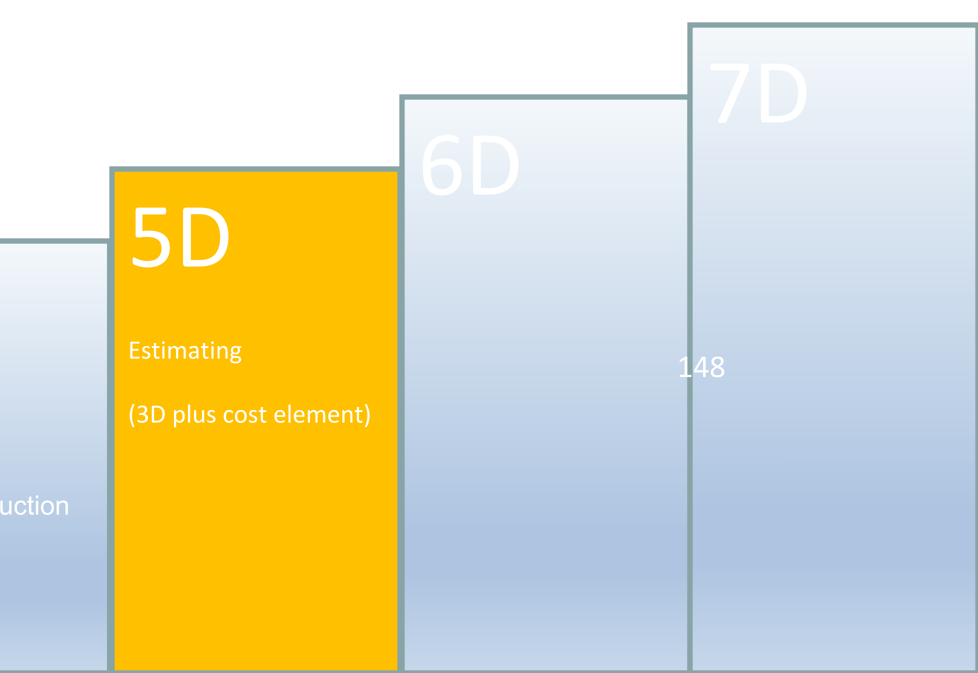


Autodesk Navisworks Manage Trapelo Logistics Plan.nwd
Type a keyword or phrase
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Animation
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Output
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Refresh
Reset All...
File Options
Project
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Select All
Select Same
Selection Tree
Find Items
Quick Find
Sets
Select & Search
Hide
Require
Hide Unselected
Unhide All
Visibility
Links
Quick Properties
Properties
Display
Clash Detective
TimeLiner
Presenter
Animator
Scripter
Batch Utility
Compare
DataTools
Tools
AUTODESK
TimeLiner
Tasks
Links
Gantt View
Configure
Rules
Simulate
Gantt Chart
Display Dates: Planned vs Actual
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3 STRUCTURAL FRAM...
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1/28/2010 8:00
3 STRUCTURAL FRAM...
4/2/2010 8:00:00 AM
4/6/2010 5:00:00 PM
2/11/2010 8:00
3 STAIRS
4/7/2010 8:00:00 AM
4/7/2010 5:00:00 PM
2/16/2010 8:00
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6/16/2010 5:00:00 PM
4/8/2010 8:00:0
ROOF SLAB PHASE 1
4/8/2010 8:00:00 AM
4/12/2010 5:00:00 PM
4/26/2010 8:00
ROOF SLAB PHASE 2
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4/15/2010 5:00:00 PM
4/29/2010 8:00
ROOF SLAB PHASE 3
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4/20/2010 5:00:00 PM
5/4/2010 8:00:0
ROOF SLAB PHASE 4
4/21/2010 8:00:00 AM
4/23/2010 5:00:00 PM
5/7/2010 8:00:0
ROOF SLAB PHASE 5
4/26/2010 8:00:00 AM
4/28/2010 5:00:00 PM
5/12/2010 8:00
534 MB
BIM arabia

5D

BIM, an acronym for 5D Building Information Modeling, is a term used in the CAD and construction industries, and refers to the intelligent linking of individual 3D CAD components or assemblies with schedule (time - 4D BIM) constraints and then with cost-related information.
The creation of 5D models enables the various participants (from architects, designers, contractors to owners) of a construction project to visualize the progress of construction activities and its related costs over time. This BIM-centric project management technique has potential to improve management and delivery of projects of any size or complexity.

- Bill of Quantity (BOQ)
- Bill of Material (BOM)
- Cost Estimation





Mechanical Schedules/Takeoffs

AIR TERMINAL SCHEDULE				
TYPE	MARK	COUNT	NECK SIZE	FLOW
SUPPLY AIR	A	1	6	80 CFM
SUPPLY AIR	A	2	10	100 CFM
SUPPLY AIR	A	2	10	400 CFM
SUPPLY AIR	A	1	10	420 CFM
TRANSFER AIR	B	2	16	480 CFM
SUPPLY AIR ROUND DIFFUSER	C	8	12	SEE PLAN
TRANSFER GRILLE	D	2	SEE KEY NOTES	500 CFM
NOTE: TRANE TO PROVIDE ALL SUPPLY AND RETURN DIFFUSERS				

DUCT SCHEDULE				
SIZE	COUNT	INSULATION THICKNESS	INTERIOR LINING THICKNESS	LENGTH
6"ø	9	1"	0"	42'-5"
8"ø	1	1"	0"	4'-6"
10"ø	18	1"	0"	47'-0"
12"ø	1	1"	0"	5'-8"
14"ø	1	1"	0"	23'-7"
16"ø	1	1"	0"	7'-7"
18"ø	2	1"	1"	16'-5"
20"ø	1	1"	0"	14'-3"
21"ø	2	1"	1"	14'-6"
14"x14"	1	1"	0"	4'-10"
16"x16"	1	1"	0"	4'-4"
22"x19"	1	1"	0"	2'-0"

FLEX DUCT SCHEDULE		
DIAMETER	COUNT	LENGTH
6"	3	25'-6"
10"	3	17'-9"
16"	1	4'-10"

FLY FAN SCHEDULE						
MARK	MANUFACTURER	MODEL	HP @ 1550 RPM	FLA	CFM	SOUND RATING
FF-1	MARS	LPN72	1 @ 1/6	2.6	1800	53
NOTE: GENERAL CONTRACTOR TO PROVIDE FLY FAN						

INDOOR UNIT																				
			SUPPLY FAN					COOLING			HEATING	FILTER		ELECTRICAL						
								CAPACITY												
MARK	AREA SERVED	MANUFACTURER AND MODEL NO.	CFM	ESP	RPM	BHP	HP	SENSIBLE (MBH)	TOTAL (MBH)	ENT. (F) DB/WB	CAPACITY (MBH)	TYPE FURNISHED	NUMBER AND SIZE	VOLT/PH /HZ	MCA	FLA	MIN. OSA	OPERATING WEIGHT (LBS)	ACCESSORIES	REMARKS
HPI-1	SALES, RESTROOMS	TRANE TWE061D3	2000	0.50 in-wg	1000	0.77	0.75	47.2	63.4	85 / 67	58.5	THROWAWAY	(1) 16x20x1	208/3/60	3.1	2.5	450 CFM	300	1 2 3 4	1 2
HPI-2	SALES, PREP, BACKROOM, OFFICE	TRANE TWA090D3	3000	0.50 in-wg	807	1.26	2.0	89.4	97.4	85 / 67	77.4	THROWAWAY	(3) 16x25x1	208/3/60	6.6	5.3	375 CFM	400	1 2 3 4	1 2

ACCESSORIES: 1 DUCT SMOKE DETECTORS 2 PROGRAMMABLE THERMOSTAT W/ LOCKING COVER 3 CO2 SENSOR 4 MIXING BOXES

REMARKS: 1 INSTALLATION SHALL BE PER MANUFACTURER RECOMMENDATION 2 WIRED BY ELECT. CONTRACTOR PER DIV. 16, SEE ELECT DWGS.

EXHAUST FAN SCHEDULE												
MARK	MANUFACTURER AND MODEL NO.	AREA SERVED	TYPE	CFM	S.P. (IN. WG.)	RPM	HP (W)	DRIVE	VOLT/PH	OPERATING WEIGHT (LBS)	ACCESSORIES	REMARK
EF-1	GRAINGER / BROAN 4TR42	WOMENS RESTROOM	CEILING	100	0.125	640	87 W	DIRECT	120/1	20	1 2 3	1 2 3
EF-2	GRAINGER / BROAN 4TR42	MENS RESTROOM	CEILING	100	0.125	640	87 W	DIRECT	120/1	20	1 2 3	1 2 3

ACCESSORIES: 1 DISCHARGE GOOSENECK 2 VIBRATION ISOLATOR WITH SEISMIC RESTRAINT 3 MOUNTING CLAMPS AND BRACKETS

REMARKS: 1 WIRED BY ELECT. CONTRACTOR PER DIV. 16, SEE ELECT DWGS. 2 INSTALLATION SHALL BE PER MANUFACTURER'S RECOMMENDATION 3 FACTORY FURNISH WITH GRILLE

OUTDOOR UNIT													
			COMPRESSOR			CONDENSER				ELECTRICAL			
						AMBIENT AIR (F)		FAN					
MARK	MANUFACTURER AND MODEL NO.	AREA SERVED	STAGE	RLA	LRA	SUMMER	WINTER	HP	CFM	VOLT/PH/HZ	MCA	FLA	OPERATING WEIGHT (LBS)
HPO-1	TRANE 4TWA3060A3	RTU-1	1	18.1	137	85	43	1/4	-	200/3/60	-	-	300
HPO-2	TRANE TWA090D3	RTU-2	1	25	164	85	43	0.5	6530	208/3/60	6.6	3.1	400

CONDENSING UNIT SCHEDULE									
					COMPRESSORS					
MARK	MANUFACTURER	MODEL	ORACLE #	VOLT/PH/ HZ	COUNT	HP	MCA	MOPD	OPERATING WEIGHT (LBS)	FOR USE WITH
RC-1	HEATCRAFT / BOHN	TPC-3	20465	208/3/60	-	5, 3/4, 1 1/2	41.2	60.0	1375	-

EVAPORATOR SCHEDULE								
MARK	COUNT	MANUFACTURER	MODEL	ORACLE#	HP	WATTS	VOLT/PH/HZ	OPERATING WEIGHT (LBS)
E-1	3	HEATCRAFT / BOHN	ADT130BEB2N6WGK	00130252	1/15	3,810	230/1/60	53
E-2	1	HEATCRAFT / BOHN	LET047BHB2N6K	00130186	1/15	3,810	208/1/60	29
E-3	1	HEATCRAFT / BOHN	LTL046	0317006	-	1,100	208/1/60	48



Plumbing Schedules/Takeoffs

Fixture Schedule									
Mark	Type	Model	Oracle #	Count	W	V	CW	HW	Description
HS-1	EHS-1 Hand Sink	180-574	00037994	1	1-1/2"	1-1/2"	1/2"	1/2"	
WC-1	Highline 2pc Toilet, Complete Solution	947-278	-	2	4"	2"	1/2"	-	Kohler "HIGHLINE" PRESSURE LITE TOILET, MODEL NO. K-3485 FOR LEFT HAND APPLICATIONS AND K-3485-RA FOR RIGHT HAND
HS-2	In Counter Hand Sink	-	-	2	2"	1-1/2"	1/2"	1/2"	7-Eleven provided
FD-1	Josam Floor Drain	Series No. 3000-5A-50	-	3	3"	2"	-	-	Cast Iron Floor Drain
LAV-1	Kohler Lavatory	K-1723	-	2	1-1/2"	1-1/2	1/2"	1/2"	W/ 8" CENTERS W/ CHROME CORALAIS K-15265-4 W/ LEVER HANDLES
MS-1	Mop Sink	MSB-2424	-	1	3"	2"	3/4"	3/4"	COLOR WHITE WITH NO. 830AA FAUCET, NO. 832-AA HOSE AND BRACKET, NO. 1453BB FLOOR STRAINER AND NO. 899-CC MOP HANGER.
FS-1	Zurn Floor Sink	Z-1900	-	4	3"	2"	-	-	12" x 12" x 6" DEEP CAST IRON BODY AND AND SQUARE SLOTTED MEDIUM DUTY GRATE.

Waste Pipe Schedule					
System	Type	Class	Model	Diameter	Length
Condensate	1" x 10' RDG Tyoe M Red Copper - C	M	-	1"	59'-7"
Waste	1-1/2" x 10' PVC40 PE Solidcore Pipe - W	Schedule 40	193-844	1 1/2"	135'-4"
Waste	2" x 10' PVC40 PE Solidcore Pipe - W	Schedule 40	193-852	2"	242'-9"
Waste	2-1/2" x 10' PVC40 PE Solidcore Pipe - W	Schedule 40	193-852	2 1/2"	6'-8"
Waste	3" x 10' PVC40 PE Solidcore Pipe - W	Schedule 40	193-860	3"	17'-4"
Waste	4" x 10' PVC40 PE Solidcore Pipe - W	Schedule 40	193-879	4"	52'-9"

Waste Pipe Fitting Schedule			
Type	Size	Count	Model
1-1/2" PVC EL 45D SXS	1 1/2"ø-1 1/2"ø	8	294-071
2" PVC EL 45D SXS	2"ø-2"ø	3	232-742
2" PVC EL 90D SXS	2"ø-2"ø	30	232-734
3" DWV EL 90D HXH	3"ø-3"ø	3	189-480
4" DWV EL 45D HXH	4"ø-4"ø	1	-
4" DWV EL 90D HXH	4"ø-4"ø	5	-
2" PVC TEE SXSXS	2"ø-2"ø-2"ø	30	232-726
3" DWV SANI TEE HXHXH	3"ø-3"ø-3"ø	4	189-707
4" DWV SANI TEE HXHXH	4"ø-4"ø-4"ø	9	189-715

Waste Pipe Accessory Schedule		
Type	Model	Count
4" DWV Test / Cleanout Tee HCHCFPT	-	4
Josam Wall Clean-out	Series No. 58790	5



Cost Estimating

Mortenson
construction

Wall Schedule

Type	Comments	Length	Width	Area (SF)	Volume (CF)	Location
10" Concrete Foundation Wall	1080-N3F	34' - 11 1/2"	0' - 10"	623	520	1080
10" Concrete Foundation Wall	1080-N3F	5' - 7"	0' - 10"	107	89	1080
10" Concrete Foundation Wall	1080-N3F	3' - 7"	0' - 10"	56	47	1080
10" Concrete Foundation Wall	1080-N3F	15' - 3 3/4"	0' - 10"	281	234	1080
10" Concrete Foundation Wall	1080-N3F	98' - 4"	0' - 10"	1483	1236	1080
10" Concrete Foundation Wall	1080-N3F	53' - 7"	0' - 10"	789	658	1080
10" Concrete Foundation Wall	1080-N3F	9' - 2 7/8"	0' - 10"	151	126	1080
10" Concrete Foundation Wall	1080-N3F	21' - 0"	0' - 10"	314	262	1080
10" Concrete Foundation Wall	1080-N3F	6' - 5 7/8"	0' - 10"	97	81	1080
10" Concrete Foundation Wall	1080-N3F	9' - 7"	0' - 10"	137	114	1080
10" Concrete Foundation Wall	1080-N3F	23' - 11 1/2"	0' - 10"	359	299	1080
10" Concrete Foundation Wall	1080-N3F	9' - 6"	0' - 10"	142	118	1080
10" Concrete Foundation Wall	1080-N3F	24' - 0"	0' - 10"	359	299	1080
10" Concrete Foundation Wall	1080-N3F	3' - 6"	0' - 10"	52	43	1080
10" Concrete Foundation Wall	1080-N3F	4' - 0"	0' - 10"	60	50	1080
10" Concrete Foundation Wall	1080-N3F	9' - 1 1/4"	0' - 10"	146	121	1080
10" Concrete Foundation Wall	1080-N3F	71' - 5 3/4"	0' - 10"	1130	942	1080
10" Concrete Foundation Wall	1080-N3F	33' - 8"	0' - 10"	587	489	1080
20" Concrete Shear Wall	1080-P2T	29' - 4"	1' - 8"	429	715	1080
20" Concrete Shear Wall	1080-P2T	36' - 0"	1' - 8"	514	857	1080
20" Concrete Shear Wall	1080-P2T	36' - 0"	1' - 8"	577	692	1080
20" Concrete Shear Wall	1080-P2T	29' - 4"	1' - 8"	114	189	1080
20" Concrete Shear Wall	1080-P2T	36' - 0"	1' - 8"	129	215	1080
20" Concrete Shear Wall	1080-P2T	36' - 0"	1' - 8"	129	215	1080
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 13/16"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	11A0
11.75" Concrete Wing Wall	11A0-P2F	10' - 1"	0' - 11 3/4"	138	136	11A0
16" Concrete Shear Wall	11A0-P2T	22' - 3 7/8"	1' - 4"	305	407	11A0
16" Concrete Shear Wall	11A0-P2T	13' - 7 3/4"	1' - 4"	181	242	11A0
20" Concrete Shear Wall	11A0-P2T	21' - 0"	1' - 8"	287	478	11A0
20" Concrete Shear Wall	11A0-P2T	5' - 0"	1' - 8"	68	114	11A0
20" Concrete Shear Wall	11A0-P2T	39' - 5"	1' - 8"	527	879	11A0
20" Concrete Shear Wall	11A0-P2T	21' - 0"	1' - 8"	287	478	11A0
20" Concrete Shear Wall	11A0-P2T	5' - 0"	1' - 8"	68	114	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	15' - 3 1/4"	0' - 9"	48	36	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	108' - 7 1/4"	0' - 9"	318	239	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	6' - 7 1/4"	0' - 9"	24	18	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	5' - 7 1/2"	0' - 9"	18	13	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	34' - 11 1/2"	0' - 9"	108	81	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	11' - 1 3/4"	0' - 9"	31	23	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	28' - 7 15/32"	0' - 9"	88	66	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	4' - 8 1/4"	0' - 9"	9	6	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	4' - 1 1/4"	0' - 9"	8	6	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	60' - 0 1/32"	0' - 9"	164	123	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	43' - 8"	0' - 9"	133	100	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	3' - 7 1/2"	0' - 9"	14	10	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	5' - 7 1/2"	0' - 9"	18	13	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	34' - 11 1/2"	0' - 9"	104	78	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	5' - 7 1/2"	0' - 9"	20	15	11A0
9" Concrete Foundation Stem Wall	11A0-N3A	3' - 7 1/2"	0' - 9"	11	8	11A0
11.75" Concrete Wing Wall	1180-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	1180
11.75" Concrete Wing Wall	1180-P2F	11' - 8 3/4"	0' - 11 3/4"	160	157	1180

- BIM combined with cost
- Model enables accurate quantity survey of materials and components
- Quantities linked directly to cost databases
- Cost implications of design changes can be understood in real-time

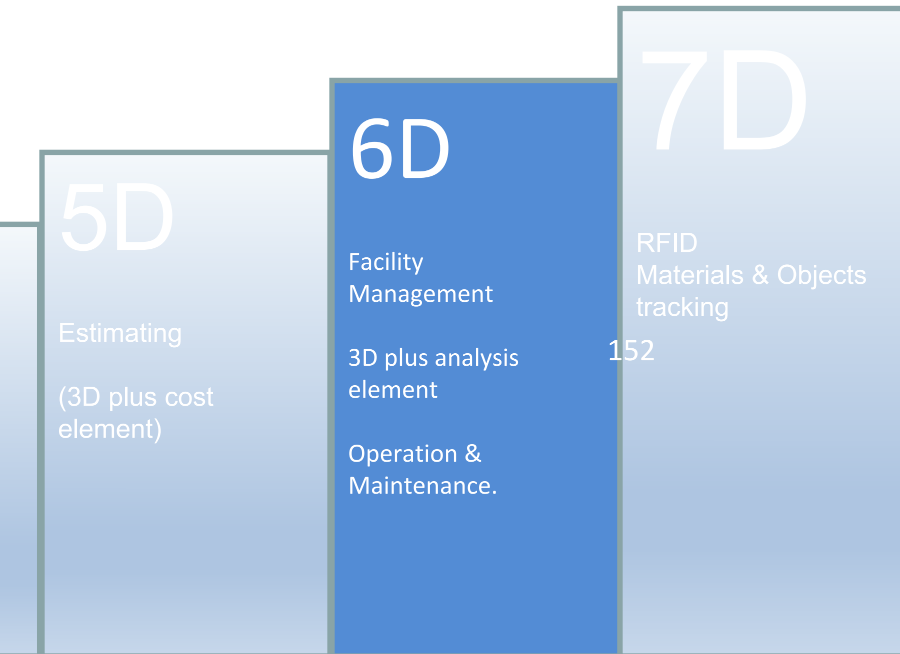


6D

BIM, an acronym for 6D Building Information Modeling and a term widely used in the Construction industry, refers to the intelligent linking of individual 3D CAD components or assemblies with all aspects of project life-cycle management information.
The 6D model is usually delivered to the owner, when a construction project is ready to be closed-out. The "As-Built" BIM model is populated with all relevant building component information such as product data and details, maintenance/operation manuals, cut sheet specifications, photos, warranty data, web links to product online sources, manufacturer information and contacts, etc. This information-centric database is made globally accessible to the users/owners through a customized proprietary secure web-based environment. The accuracy of 6D BIM aids facilities managers in the operation and maintenance of the facility throughout its life cycle.

-Facility Management
-Logistics
-3D Laser Scan
-Operation & Maintenance





BIM arabia

7D

RFID
Objects Tracking
Assets Management
Construction Quality Control

2D

Sheets
Plan
Section
Elevation

3D

Visualization
3D-Coordination
Clash Analysis

4D

Construction sequencing

Virtual Construction

(3D plus time element)

5D

Estimating

(3D plus cost element)

6D

Facility Management

Forensic analysis

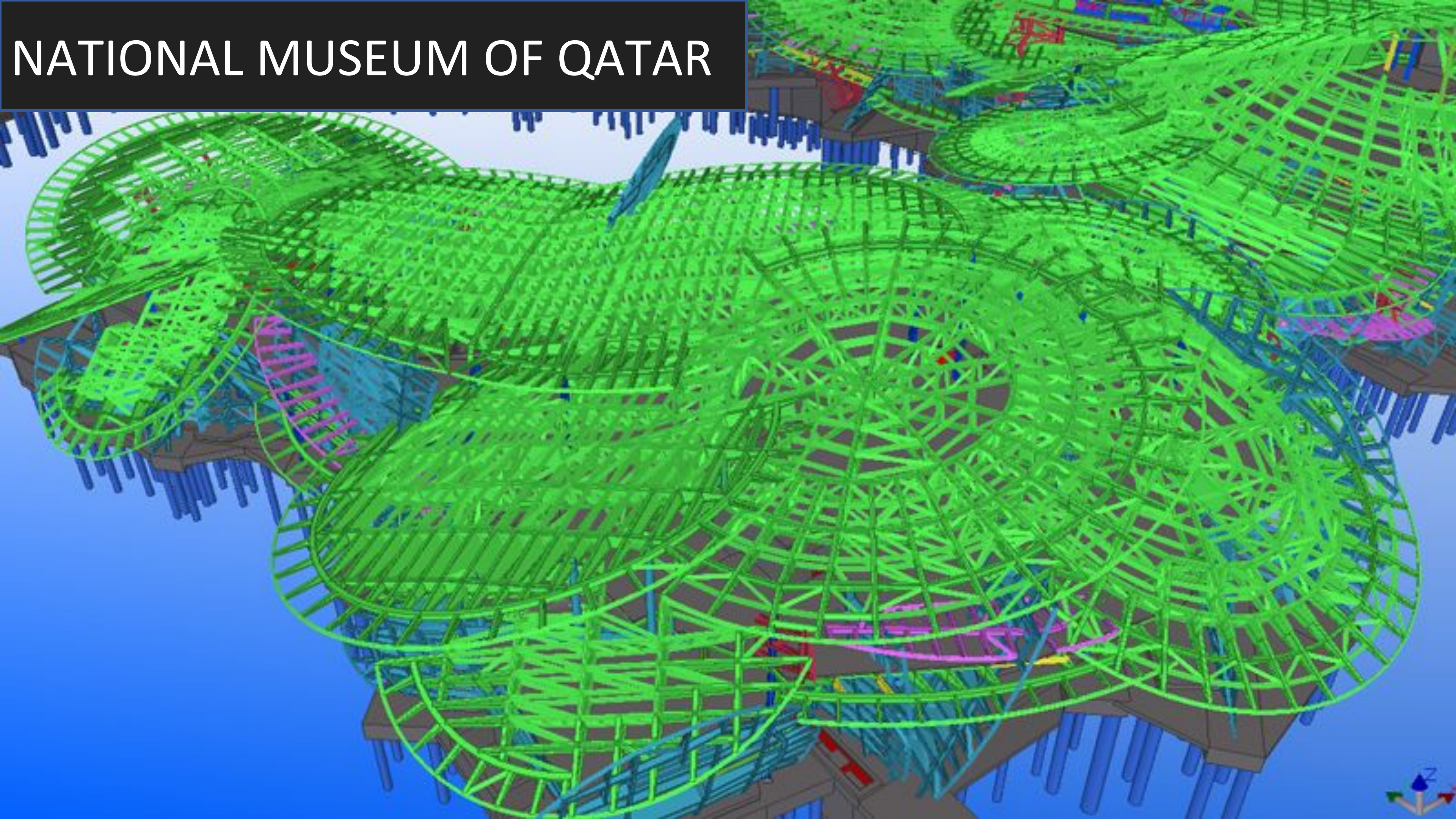
(3D plus analysis element)

7D

RFID
Materials & Objects tracking




LUSAIL CITY


NATIONAL MUSEUM OF QATAR

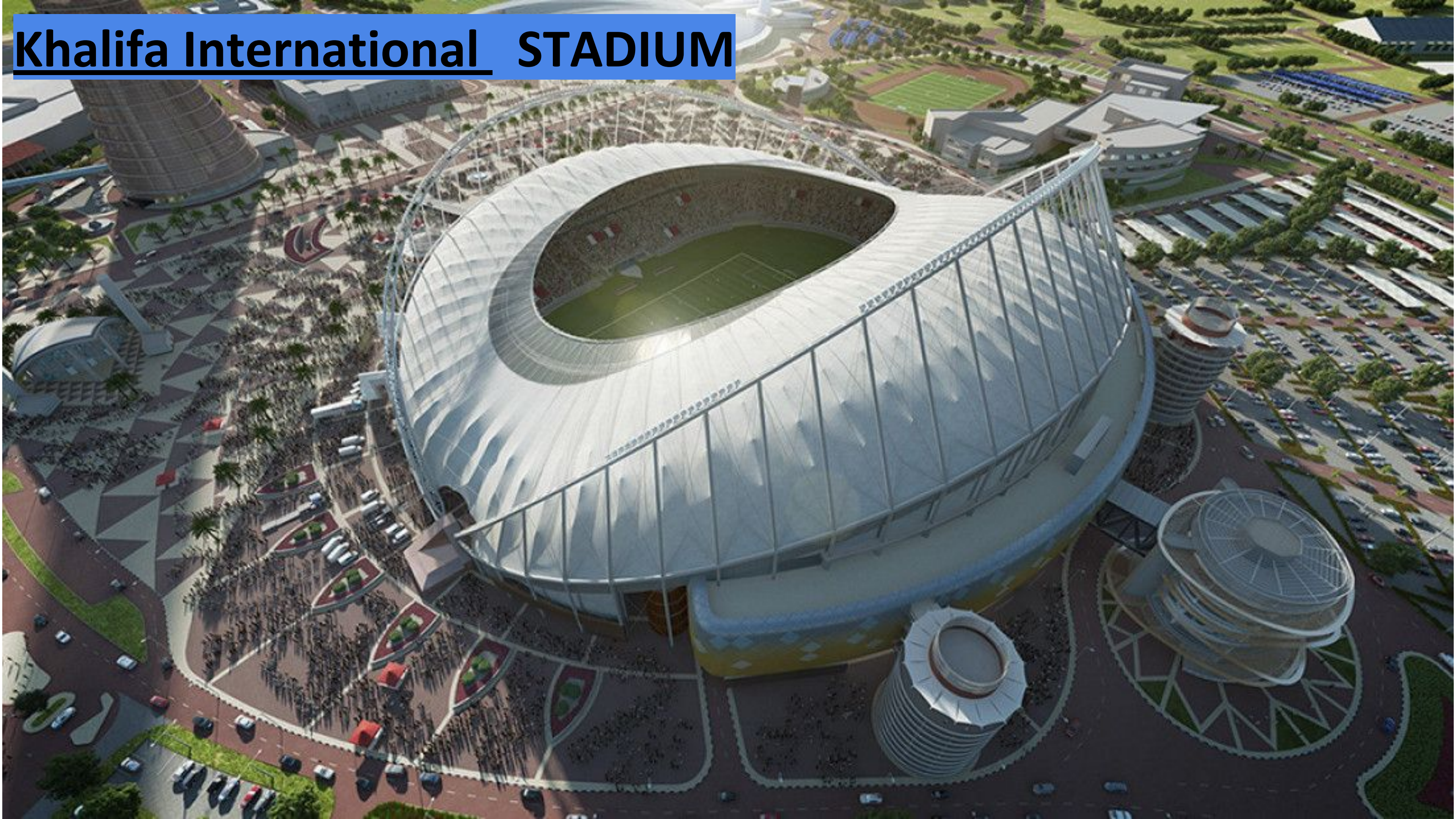

Lusail STADIUM


AL-KHOR STADIUM


AL-RAYYAN STADIUM


Al Wakrah STADIUM

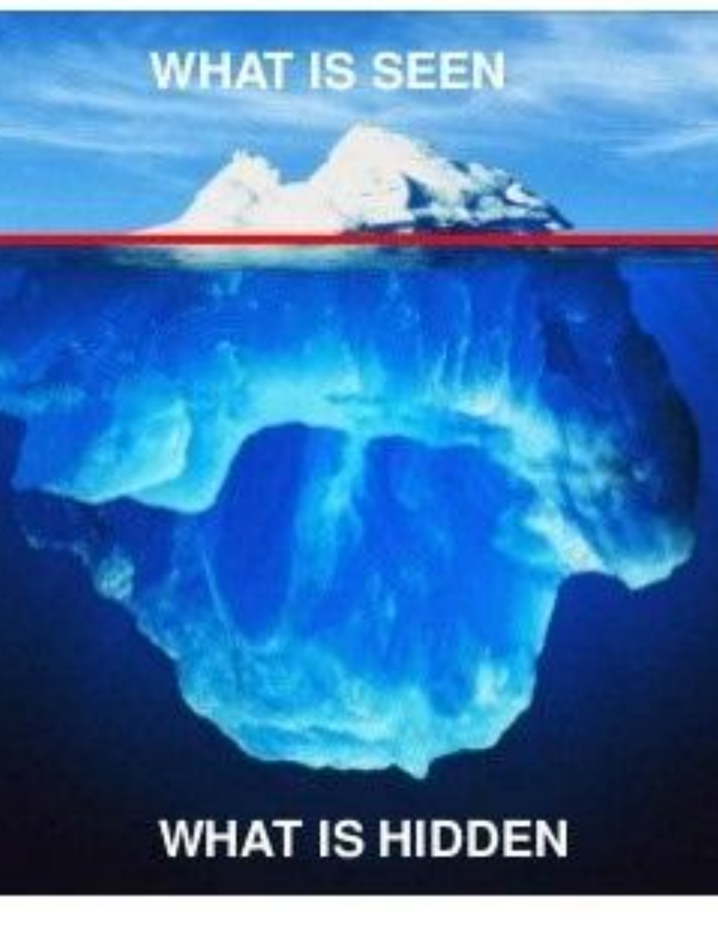
Khalifa International STADIUM

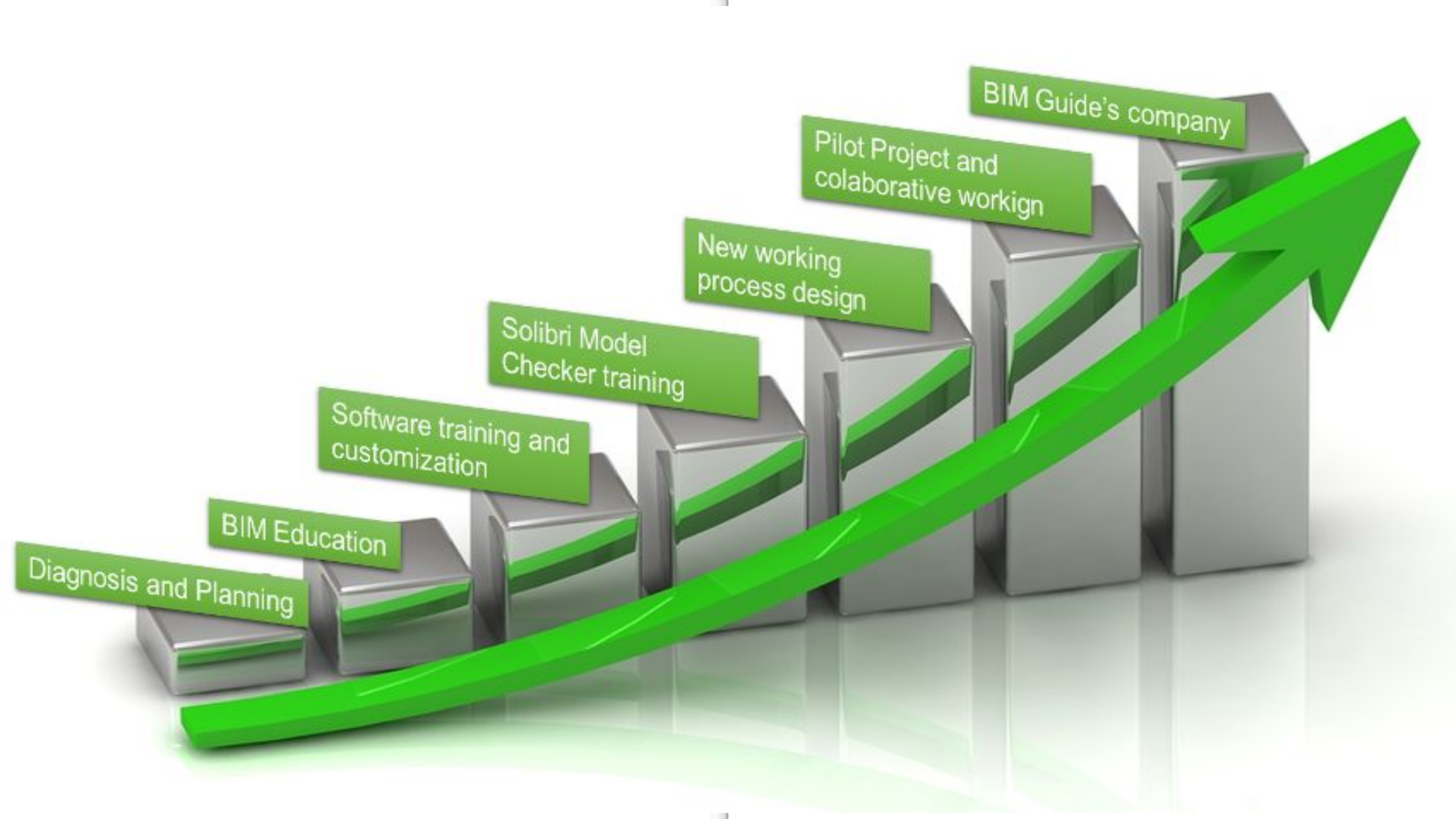



Traffic Control Centre


MALL OF QATAR
MALL of QATAR
mall

BIM Implementation Process - Evaluate





Diagnosis and Planning
BIM Education
Software training and customization
Solibri Model Checker training
New working process design
Pilot Project and colaborative workign
BIM Guide's company

BIM IMPLEMENTATION PLAN

05 transition other teams

04 **Pilot Project**
And collaboration between disciplines

03 **Training**
Special team

02 **Education**

01 **planing**
How to adopt BIM

“we are moving to BIM because it’s critical to our future,”



Creating climate for change

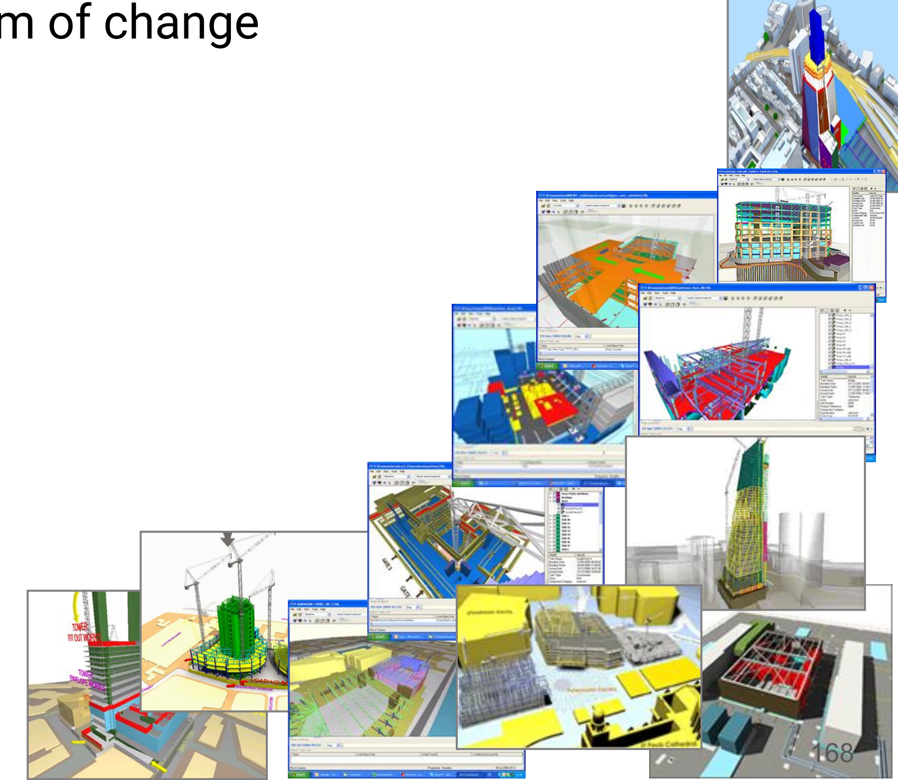
- Define urgency for change - e.g. to meet BIM e-submissions or new project procurement requirements
- Define clear vision, goals and programme
- Understand key risks and success factors
- Formulate change strategies and levers



- Engaging and enabling the change
  - Communication for buy-in o Communicate the mandate for change clearly and frequently
  - Share success stories in practice workshops
  - Solicit and address implementation issues from the ground
- Enabling actions
  - Provide training and resources
  - Acquire equipments and software
  - Define BIM standards



- Achieve quick wins – to build momentum of change
  - Use pilot project
  - Reward early movers
  - Set realistic targets





CHANGE MANAGEMENT

- Implementing and sustaining the change (12 – 24 months and beyond)
  - Propagation (from project to project or team to team)
  - Setup quick start template for new teams or projects to follow
  - Set up a progression path for teams to develop in-depth knowledge
- Making it stick
  - Define clear ownership and accountability
  - Set up reward system
  - Incorporate BIM practices as part of the organisation's ISO processes



BIM ENVIRONMENT (HARDWARE AND SOFTWARE)

- a. List of commonly used software for each task.
  - BIM authoring software
  - BIM reviewing software
  - BIM Coordination software
  - Analysis software
  - Others
- b. Hardware that can run each software with a sizable model comfortably
  c. Document management system or project coordination workspace and protocol to house, manage and share the BIM models created within the organization and with external project partners.



Supervision Plan

Design CAD File

Specification

Submittal Register

Installation

Product Data

Manual

Warranty

Spare

Test

Certification

Design

Build

Operate

Phases

Devices

PC/Notebook

Tablet

Smartphone

Apps

BIM

DMS

Hydraulic/ Structure / Road Alignment

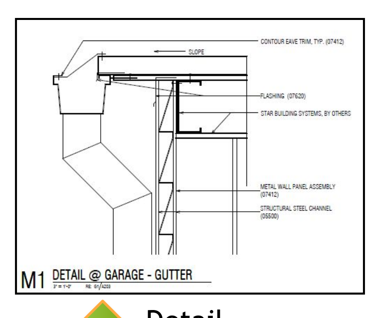
Site Records System

Material order, delivery Sys

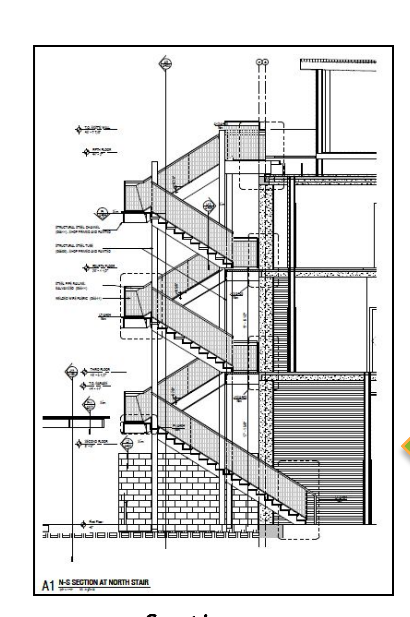
Data

Database

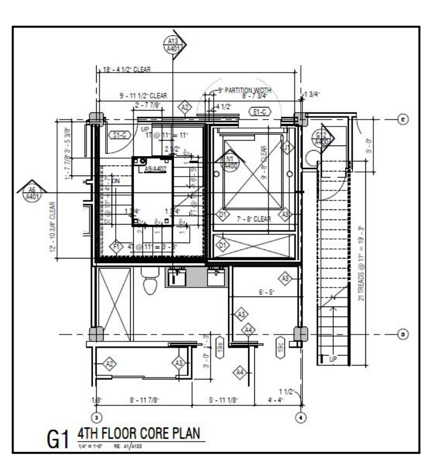




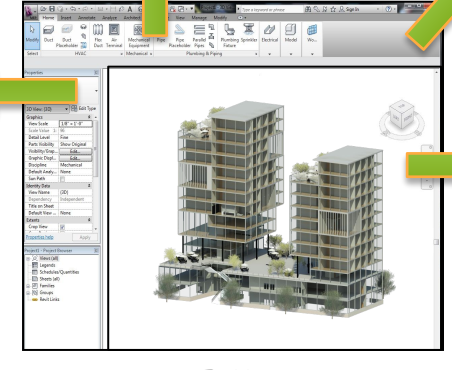
Detail



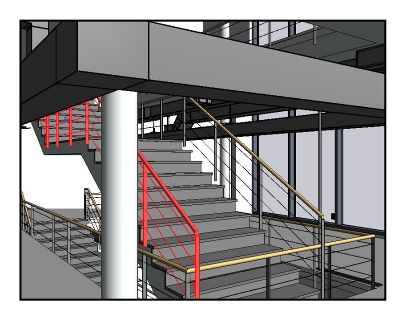
Section



Plan

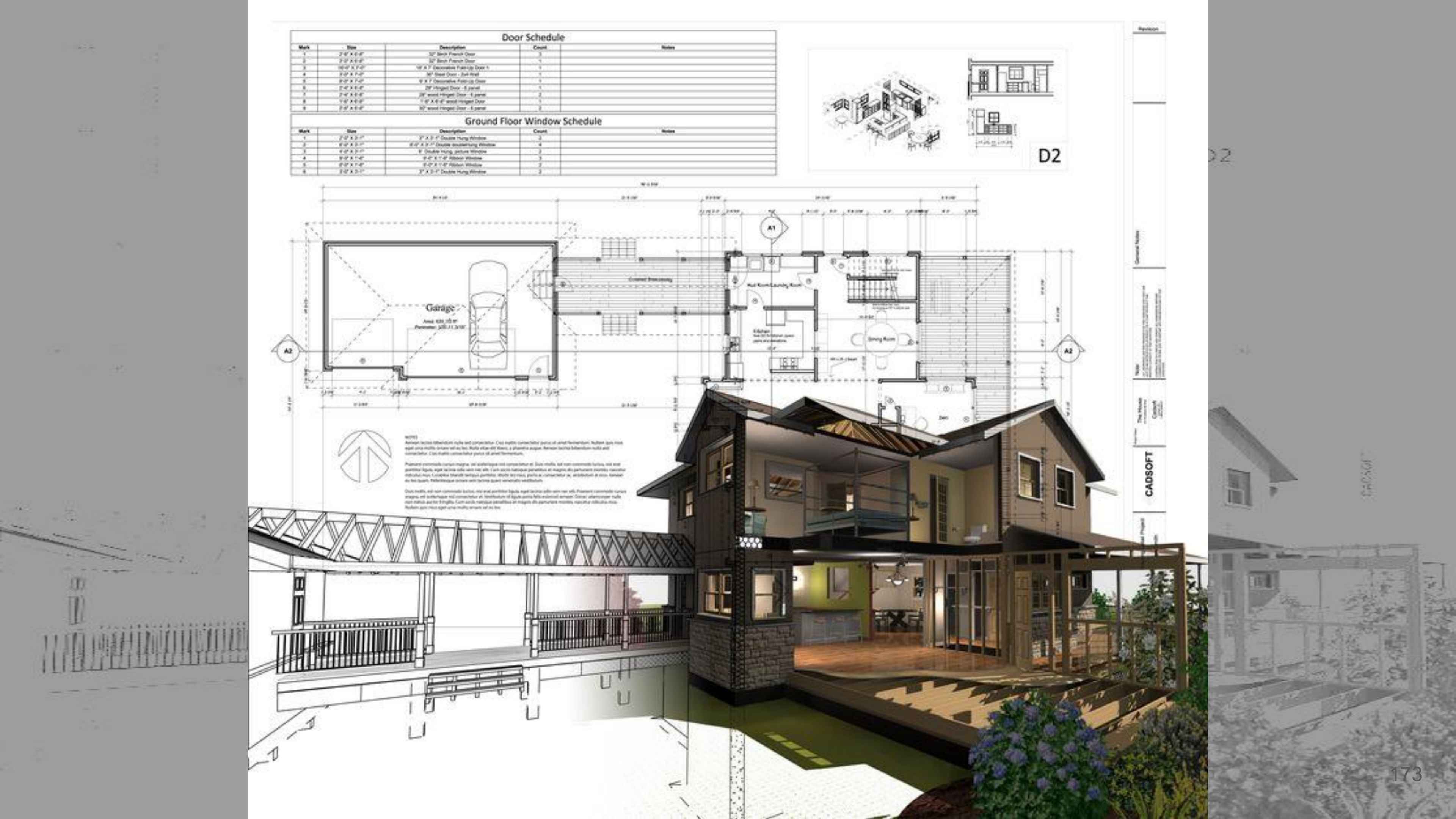



BIM




3D





Door Schedule
Ground Floor Window Schedule
D2
Garage
CADSOFT

If you have any further questions, please don't hesitate to contact me.

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THANK YOU FOR YOUR ATTENTION